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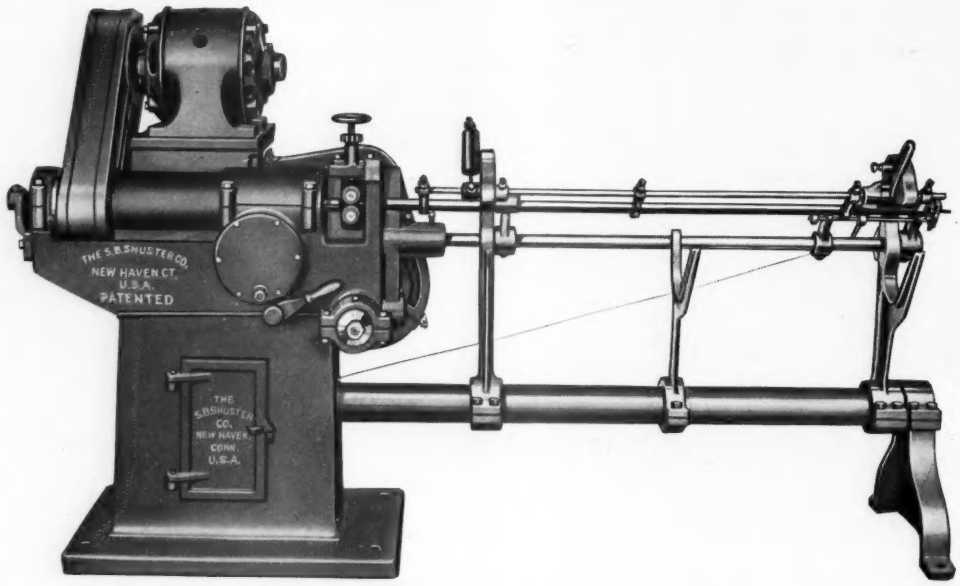

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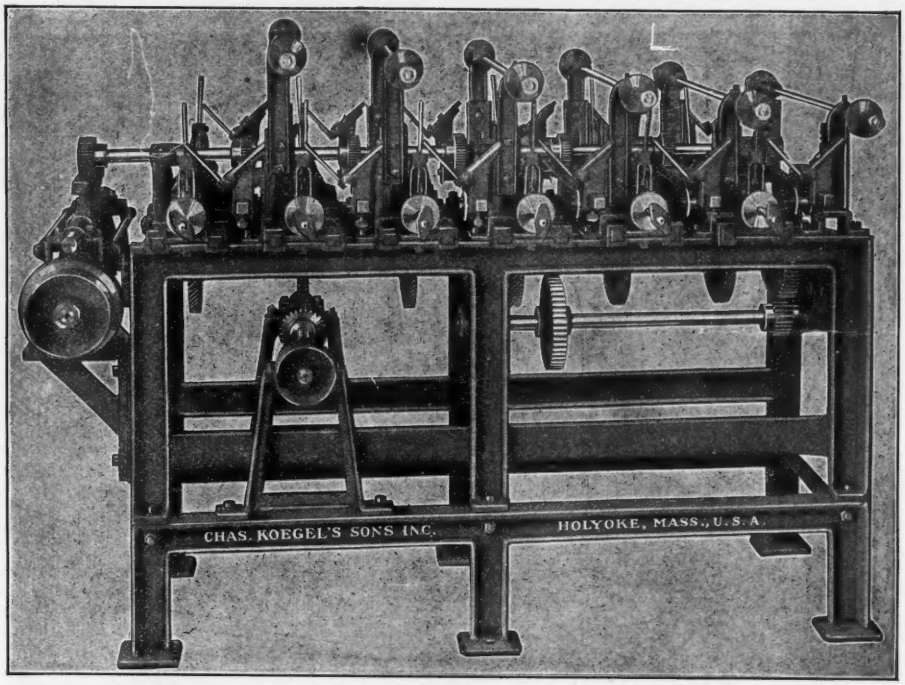

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19	.03589	2.16	2.62	3.00
20	.03196	1.53	2.20	2.50
21	.02846	1.53	2.08	2.00
22	.02535	1.53	1.92	1.50
23	.02257	1.53	1.92	1.25
24	.0201	1.28	1.70	1.00
25	.0179	.77	1.06	1.00
26	.01594	.77	.98	.87½
27	.0142	.77	.98	.87½
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THIS month thousands of young graduates from technical schools will be deluged with advice about their future movements in the industrial world. We hope all of it will be as stimulating as this glimpse of their future from Dr. Baker, President of Carnegie Institute of Technology, quoted from his annual report to the trustees.

Looking ahead twenty years, he suggests that "we may assume that business organizations will be bigger; that the duties of all forms of employes, both mechanical and administrative, will be more nearly standardized than is the case even today; that specialization will become narrower and more intense. If this guess is a correct one, the individual is likely to be a smaller unit in a greater organism. His duties are likely to be more definitely prescribed and to offer fewer opportunities for initiative and originality."

If specialization is likely to become narrower, and, as a result, the range of employment more limited, the colleges should attempt to give to the student of technology interests beyond the narrow range of his vocation."

An increasing demand for salesmen who can talk in the vernacular of the engineer is a trend that colleges need to study if education is to keep pace with the demands of business and industry, Dr. Baker asserts, declaring that "the graduates of technological schools should find a larger field for their services in those branches of industry which have to do with management, distribution and marketing rather than with the more strictly engineering work."

Here is confirmation from high authority for our own contention that the prizes in modern industry are going to the men most thoroughly informed about their special fields—which leads logically to the suggestion that a journal like *Wire & Wire Products* is indispensable to the wire mill executive who would keep abreast of developments.

The Publishers

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 3 **June, 1928** **No. 6**

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WIRE
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Vol. 3 JUNE, 1928 No. 6

Drawing Steel Alloy Wires

The application of cold work to miscellaneous alloys and to high speed and stainless steels

By J. D. Brunton

Brunton's Research Laboratory, Musselbergh, Scotland

THE difficulties presented in cold working special steels as compared with ordinary carbon steels require special precautions in cleaning, annealing and quenching. The author's reports of alterations in structure are illustrated with photomicrographic sections of wires made from specified formulae. The next contribution in the series will discuss the mechanical testing of steel wire.

OF recent years a number of steel alloys have been introduced to meet specific purposes, and, as most of these alloys can be drawn into wire, a number of them were soon called for.

Most of the alloy steels are finally used in the heat-treated condition—i. e., either hardened or tempered in the form of tools, or in the hardened and toughened condition for machine and engine parts, where great strength is required. They are seldom used in the cold drawn condition, because the valuable properties of the special alloying elements would be lost in this condition. Moreover, the structure of the alloy steels is not so suitable for drawing and toughening by cold working processes as is that of the plain carbon steels. The application of cold work to alloy steel resolves itself into a means of reducing them to a certain size and shape, in the form of a round, square, octagon, or other shaped wire. The operations, therefore, consist in annealing to bring the steel into its softest and most ductile condition, followed by cleaning and drawing.

Since alloy steels are mostly of a refractory nature to cold working operations, or, in other words, more difficult to draw into wire than ordinary carbon steels, it follows that very special precautions have to be taken in cleaning and in the reduction between annealings.

Among the first of the alloy steels to be produced was a nickel steel containing about 3% nickel. It was found that the addition of small quantities of nickel to ordinary steels made them more easily hardened—i. e., they could be hardened by quenching in a less drastic manner than when nickel was absent. Indeed, a steel containing 7% nickel and 0.5% carbon is hardened by cooling in air, while a lower percentage of nickel is sufficient to enable a steel containing only .25% carbon to be hardened by quenching in oil.

It is not, however, the property of hardness that is sought in such steels, but toughness, or great strength combined with ductility. This toughness, nevertheless, is due essentially to the capacity of the steel for hardening; in the first place, because it is the hardening operation that produces the fine grain and the finely divided internal structure, which is the feature of alloy steels toughened by oil-quenching and re-heating. The brittleness of the quench hardened steel is removed by subsequently re-heating to a temperature below the critical range, which modifies the structure in such a way that the hard constituents are uniformly distributed as minute particles in a soft and ductile matrix while the fine grain obtained by quenching is retained. Ordinary carbon steels can also be toughened to some extent in the same way, but not so efficiently as nickel steels; in the first place because they have to contain more carbon, and have to be quenched more drastically, with more risk of cracking; and secondly because the resulting structure is not so fine in the grain. The difference in structures is illustrated in Figs. 1 and 2.

As the study of alloy steels advanced, it was found that the addition of chromium and vanadium as well as nickel still further improved the properties, and the development of these has been the outstanding feature of metallurgical science within recent years.

In addition to this type of alloy, many others have been developed to meet different re-

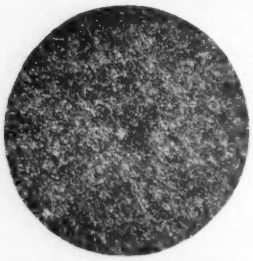


Fig. 1—Transverse Section. V-150-X 3% Nickel Steel. Heat Treated.

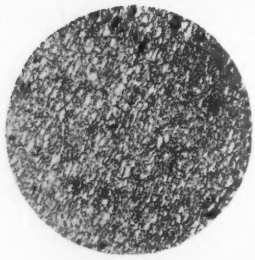


Fig. 2—Transverse Section. V-150-X. 0.50% Carbon Steel. Heat Treated.

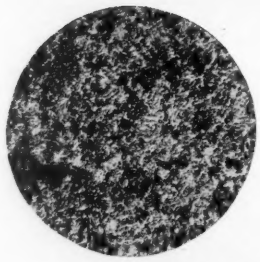


Fig. 3—Longitudinal Section. V-150-X. 3% Nickel Steel. Annealed and Drawn.

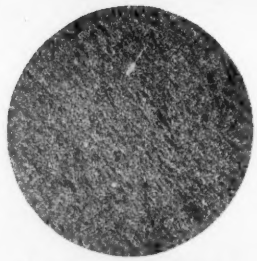


Fig. 4—Transverse Section. V.-1500-X. High Speed Steel. Annealed.

quirements. Of this miscellaneous class, two only need be specially mentioned here—viz: high speed steels and stainless steel—and in this chapter we have to consider the application of cold work in general to these alloys, and particularly to describe how wire-drawing must be modified when dealing with them.

For steels of the first, and most important, type—viz: in the form of wire—there is little demand, because carbon steel wire, which is equally as good and probably superior, can readily be obtained at less cost. The various processes through which steel has to pass in the manufacture of wire so enhance its physical properties that ordinary carbon steel in the form of wire is a product of the metallurgist's art which is second to none. Two instances only will serve to illustrate this. For the manufacture of springs in such sizes where the use of wire is inevitable, it has been found that high tensile carbon steel wire is at least equal, if not superior, to the finest alloy steel springs. In the strings of a modern piano we have an example of what may be described as the strongest and toughest article in the world: a product not of an alloy but a straight carbon steel.

Although steels of the nickel and nickel-chrome type are seldom required in the form of fine wire, they are frequently required in the form of bright bar and specially shaped sections, and it is in the production of these that the cold drawing process is applied. There is, however, little difference in the manipulation of these from that of mild or medium steel bars. A little more care in such preliminary operations as annealing and cleaning, and in the final drawing, is all that is necessary.

In annealing, more careful control of temperature and in cooling down is required, particularly when the alloy is of the

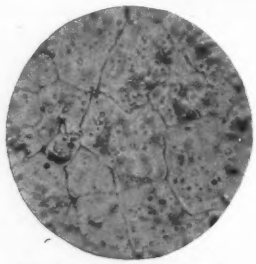


Fig. 5—Transverse Section. V-1500-X. High Speed Steel. Hardened.

air hardening type. The best annealing temperature is about 650°C. in which case the rate of Cooling is not important. If annealing is carried out above the critical temperature, cooling must be very slow to avoid any hardening.

When properly softened, these steels present little difficulty in drawing, but they harden up more quickly than mild steels and have to be reduced in fewer or lighter passes between each annealing.

High Speed Steel

This is probably the most important alloy of steel that is cold drawn; it is used for twist drills and all kinds of small tools where a keen cutting edge is required, which will stand up under rapid machining conditions. Where parallel shanked twist drills are concerned, the twist drill makers use cold drawn high speed steel from ½" to the smallest size. This steel contains, as a rule, from 12½% to 18% tungsten; of recent years the tungsten has been in some cases replaced by molybdenum and cobalt, but by far the most common is the tungsten alloy. A typical analysis of a high speed steel, suitable for drills and for wire-drawing, is as follows:—

Carbon	.60%
Silicon	.20%
Manganese	.30%
Sulphur	.02%
Phosphorus	.02%
Chromium	3.50%
Vanadium	.50%
Tungsten	14.00%

The drawing of this steel has to be done very gradually, otherwise very fine hair cracks may develop when the annealing process is performed.

The reduction in area of a high speed steel of an analysis such as shown will be about 10% for each pass through the die. When one gets down to the smaller sizes it is possible to pass it through the die twice between each annealing; but in the thicker sizes,—that is to say from ½" down to $\frac{3}{16}$"—it should not be passed through the die more than once between each annealing.

The annealing of high speed steel has to be conducted with great care in order to ensure the greatest possible softening of the alloy. The steel has to be heated up in a sealed pot to about 850°C. and soaked at this temperature for a few hours. After thoroughly soaking, the pot is taken out of the furnace and put into a cooling pit to keep it free from draughts and permit of slow cooling. It is important that the pot be allowed to cool completely before un-

Fig. 6—Transverse Section. V-500-X. Stainless Steel. Hardened and Tempered.

Fig. 7—Longitudinal Section. V-600-X. 25% Nickel Steel. Annealed.

Fig. 8—Longitudinal Section. V-600-X. 25% Nickel Steel. Drawn.

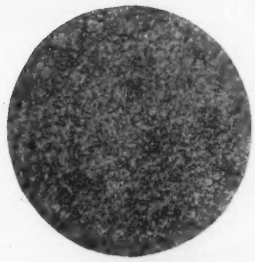


Fig. 9—Transverse Section. V-250-X. 2% Tungsten Steel. Wire Annealed.

loading, otherwise contraction cracks may develop on the wire and a hard skin will be produced, which prevents further drawing.

The structure produced by this annealing is illustrated in Fig. 4. It will be noticed that it is globular in nature, the white globules being the hard constituents embedded in a softer matrix. Curiously enough, as in the carbon steels, cold work assists in the production of this globular structure, and explains to some extent why the wire becomes softer after it has been annealed and drawn down several times. This, along with the fact that thin wire is more easily drawn than thick, makes it possible to draw the wire more than one pass between each annealing in the final stages.

The structure of high speed steel is not appreciably altered by drawing, because the reduction must of necessity be slight. It is completely altered by hardening, however, as will be seen from Fig. 5. All but the largest globules have been absorbed in a solid solution of the double carbides of chromium and tungsten in iron.

The cleaning of high speed steel may be performed by immersion in cold hydrochloric acid or hot vitriol. The time required is, of course, greater than with ordinary wire rods.

Stainless Steel

With the introduction of any new alloy we are sooner or later faced with the problem of drawing it into wire. It is, natural therefore that we should consider the position of stainless steel and stainless iron in relation to wire-drawing.

The former is an alloy steel of the air-hardening type, and it is only when in the hardened condition that it is really rustless. Moreover, like the nickel and nickel-chrome steels, it has not a suitable structure for cold working operations. Stainless

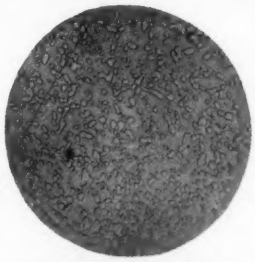


Fig. 10—Transverse Section. V-1500-X. High Speed Steel Substitute containing Cobalt. Annealed.

iron is rustless when thoroughly cleaned either in the annealed or hard drawn condition, but it is limited in strength to a maximum tenacity of about 70 tons to the square inch. It will thus be seen that the uses of stainless steels in the form of wire are limited by other considerations than cost. The author has frequently been asked why stainless steel cannot be used instead of ordinary carbon steels for the manufacture of high tensile wires, and it might be of interest to state the reasons more fully here.

Stainless steel is not suitable for the production of high tensile wire for the following reasons:—

(1) If annealed its tensile strength is somewhere about 50 tons to the square inch, and even when it is hard drawn from this condition its strength cannot be raised much above 70 tons to the square inch.

(2) It loses ductility in drawing much more rapidly than ordinary steel; to such an extent indeed that after two or, at the most, three passes through the draw-plate it becomes overdrawn and brittle.

(3) Stainless steel wire can be hardened and tempered to give a tensile strength of 100 tons to the square inch, but in this form is extremely brittle.

(4) Before it can be made sufficiently ductile to be drawn, it has to be tempered to at least 70 tons to the square inch.

(5) Even when tempered to this extent it can be drawn only with great difficulty; indeed it is doubtful if drawing in long lengths is practicable. It is one thing to draw sample pieces of about a pound in weight, and quite another to draw pieces of a cwt., or even ½-cwt. It is very difficult to get a draw-plate to stand up for any length of time in drawing stainless steel, especially in the semi-hardened condition.

(6) Even if the difficulty of drawing could be surmounted, the tenacity cannot be greatly increased by drawing. After two passes the wire reaches a tenacity of about 80 tons to the square inch, and further drawing not only makes the wire exceedingly brittle, but fails to increase the tenacity beyond about 90 tons to the square inch. Odd samples have reached a higher figure, but only occasionally, and at the expense of ductility.

(7) No matter how it is heat-treated and drawn, if the tenacity is raised beyond 70 tons to the square inch, the wire is unreliable as regards ductility tests—such as torsion and reverse bending.

(8) Only straight carbon steels in the patented condition are really suitable for the production of high tensile wire.

(9) The difficulties of drawing high tensile stainless wire in bulk are enormous, and, even if they can be surmounted, it will involve a very large increase in the already high cost of the raw material.

Importance of Lubrication

With regard to the actual manufacture of stainless steel wire, there are considerable difficulties to be overcome. Stainless iron or steel contains approximately 14% chromium, and the presence of chromium greatly increases the difficulty of drawing iron or steel. This difficulty is chiefly due to increased friction between the wire and the draw-plate; the contour of the latter is thus easily destroyed — "pulled out" — with the result that the wire is not uniform in diameter from one end of the coil to the other and is also liable to be badly scratched in drawing. Special attention has, therefore, to be paid to lubrication in drawing stainless steel and, indeed, to most alloys containing chromium. The reduction between each annealing has also to be reduced considerably, the reduction per pass being from 10 to 20%, and the total reduction between annealing seldom exceeding 40%.

Another very important matter is cleaning. It is now well known that the failure of many "stainless" steel, and particularly "stainless" iron, products to resist corrosion has been due to imperfect cleaning of the surface. At one time it was thought that the stainless properties of the alloys were largely due to the high polish, but this is not the case. Stainless alloys are perfectly rustless in rough unpolished state provided they are thoroughly clean on the surface. The least speck of dirt, rolling mill scale, or foreign matter is sufficient to act as a centre for corrosion. In stainless steel articles, like cutlery, cause the outer surface is removcleaning is not so important, be-d; but grinding is not possible with wire, and pickling, or sand blasting are the only methods of obtaining a clean bright metallic surface.

Stainless steels can be pickled in sulphuric acid, but this attacks the steel and causes disintegration of the alloy at the surface, leaving a black scum on the wire which cannot be removed by washing. This scum not only interferes with drawing, but renders the surface of the wire liable to attack by corrosive media. Thus, while pickling in acid may be employed as a means of removing the rolling mill scale, it cannot be considered a satisfactory method for the final cleaning operation. The most satisfactory method now adopted is electrolytic cleaning.

There are two methods which may be adopted in cleaning metals by electrolysis:

(1) in which the metal to be cleaned is made the anode or positive pole in the circuit,

(2) where the metal to be cleaned is made the cathode or negative pole.

In the first method, slight solution of the metal is involved, which may be objectionable; while in the second method, the cleaning action is entirely mechanical, being due to the rapid evolution of hydrogen.

Electrolytic Cleaning

Various types of electrolytes have been used for electrolytic cleaning, and the choice of a suitable solution depends on circumstances. It is inadvisable, however, to select a solution which has in itself a solvent action on the metal; thus acid solutions should be avoided. Cyanide solutions have been used with some success, but have the objection of being poisonous. Probably the most suitable solutions are those having a base of caustic soda, with the addition of salts to increase the electrical conductivity, such as sodium sulphate or chloride.

The annealing of stainless steel or iron may be conducted in an open muffle without danger of serious scaling because the maximum annealing temperature is about 750°C., and at this temperature the surface of the steel is not seriously oxidized. There is no occasion for slow cooling, because the steel does not harden unless heated above 800°C.

Sometimes it is advisable to harden the steel slightly before drawing in order to increase the tenacity of the wire. This, of course, increases the difficulty of drawing, but it is the only suitable method of producing stainless steel wire with a tensile strength of from 80/90 tons per square inch. For this purpose it is necessary to heat the steel to a temperature of about 950°C., and air harden it, and finally to temper it sufficiently to obtain the necessary ductility for wire drawing.

Abuse of Stainless Steels

While stainless steel is being used for a variety of products today—such as spokes for motor cars and bicycles, pins, safety pins, spring wire that has to stand up in heat and damp vapour, etc., etc., there is a natural tendency to expect too much of it. Quite apart from questions of cost, stainless steel is not so suitable for the production of high grade wire as straight carbon steel.

The most important application of the original stainless steel has been in the manufacture of cutlery, and in the form of wire its most useful application is as a stainless substitute for steels to harden and temper for springs, needles, dental and surgical instruments, etc.

Stainless iron, on the other hand, if it can be produced at reasonable cost, may have very wide applications in the form of wire where resistance to corrosion is of great importance than strength. More recently other stainless alloys containing nickel in addition to chromium have been introduced and since they lend themselves to cold drawing more than stainless steel they have probably a better future before them as far as wire products are concerned.

(*Please turn to page 210*)

The Development Of The Diamond Drawing Die

How one big American manufacturer has cut production costs one-third while improving quality

By Evelyn Kay

Head of the Diamond Die Department, Driver-Harris Company

THIS interesting sidelight on the evolution of diamond die manufacture in American shops comes coincidentally with the announcement that the Driver-Harris Company has discontinued its diemaking department to take over the entire output of a French manufacturer. The new dies will be placed on the market at once.

FOR the past twenty years this company has maintained its own diamond die department. For the first few years this off-shoot of a plant primarily concerned with making wire was chiefly devoted to repairs and experiments, but since nineteen thirteen we have been turning out dies of our own manufacture for use in our own drawing equipment.

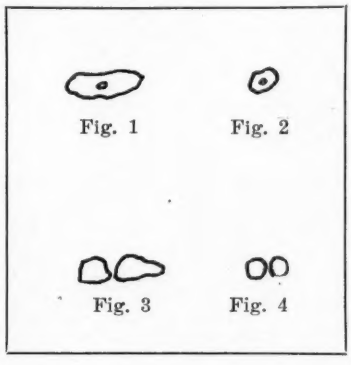
During the last few years, however, we have also been using dies made in France which in stone quality and workmanship proved up to the standard of our own shops. We have, therefore, taken over the entire output of this foreign manufacturer.

When the demand for nickle, monel metal and hard alloy wires became an important factor in the industry, the possession of a complete die making unit of our own was of obvious advantage in designing experimental tools to meet changing conditions in wire drawing requirements.

One of the first difficulties encountered by the American manufacturer of diamond dies is the lack of skilled domestic labor. Foreign manufacturers have the advantage of being able to recruit an abundance of help in trades requiring skill and precision that are scarce and expensive on this side of the water. Faced by this handicap in the matter of production cost, the American producer is forced to seek other ways to offset it.

In our own case there was the difficulty of getting industrial diamonds of the right sizes and shapes to suit our requirements, but this search for raw materials is one of the inevitable drawbacks to pioneering in any industrial field and eventually rights itself as the market broadens.

Our greatest progress was made after effort was concentrated on design and construction—so much so that within the past six years the cost of making our dies has been reduced a third. This forward step was the result of abandoning the old-fashioned conception of diamond die construction and approaching it from a wholly new angle.



For instance, it was generally held, up to that time, that the diamond had to be a very large stone in order to stand up satisfactorily in use. In those days an .0225 die would be fitted with a diamond weighing 2½ carats. Seemingly no one gave much thought to the now obvious fact that the wire drawer was really only getting the use of about one carat if the two and a half carats were spread over an area as indicated in Figure 1.

About this time we discovered that the better grades of stones come in the smaller weights and since then we have used stones one-third the size of our former specifications. We select round, chunky diamonds (Figure 2) that will give us just as much of the all-important *wall* as the larger sizes and that have the requisite depth and thickness for a properly shaped bearing.

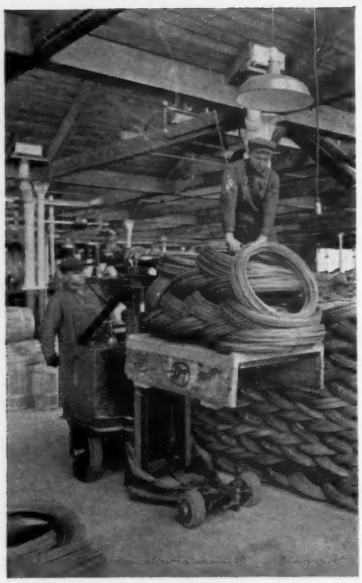
From our own experience and experiments we came to the conclusion that the hitherto neglected matter of shape could scarcely be given too much importance in the design of dies. Consider, for example, the shape we abandoned some years ago (Figure 3). The long tapered bearing left the back very sharp, with the result that when the wire passed through the bearing at a high rate of speed the weak back would chip off. Frequently, too, when the wire started to run off size it would rip a piece out of the back of the stone, leaving it unfit for further use. Once it became apparent that the heaviest strain was on the back of the die we concentrated reinforcement there by making our newer models the shape indicated in Figure 4. With the wide open cone in the back the wire is drawn through smoothly without strain on the bearing,

(*Please turn to page 209*)

Wire Handling with the Electric Truck

Industrial applications that have made materials handling equipment pay for itself.

Actual experience with electric handling equipment in wire, rod and strip mills form the substance of this report on new developments in battery trucks and cranes. The data on savings in time, labor, and money are selected from reports on operating performance made by engineers of the Society for Electrical Development.



The loss of time required for loading and unloading coils by hand led to the elevating platform truck that picks up and carries a load previously placed on a skid platform.

Wire Rod And Strip Mills Operations

Rod or strip from mill:
to cooling floor
to scales
to storage
to annealing
to pickling department
to cold rolls
to annealing
to pickling
to shipping storage
to cars

Scrap to baler and shipping department

Rolls, between machine shop, storage and rolling mill

IN the rod mill or the strip mill, as in all plants where these products have to be handled subsequently, an unusual opportunity for large savings exists through the use of truck equipment that is particularly fitted for this service. What holds for the steel industry's operations, applies no less in the copper and brass plant, where a parallel series of handling problems is presented.

The difficulties involved in handling these materials are generally appreciated. A prime consideration involved in the selection of equipment for this work is flexibility. Wire as it comes hot from the mill is heavy, bulky and awkward to handle —thus making it necessary to meet a set of special conditions. Further, for this work as for all other handling jobs in the industry, it is absolutely essential that equipment to be employed be sturdy.

If men are to be taken from this work, it is necessary to substitute equipment which will perform so consistently that need for reverting to old methods will not arise, as obviously would be the case in the event of periodic breakdowns.

A few years ago, when it was first proposed to put ram trucks in the hot strip department of a mid-west steel mill for carrying the hot rods of metal to the cooling floor, the superintendent said flatly: "If trucks come here, I go out." To him it seemed suicidal to attempt to do the job with machines so much larger than the hand trucks to which he had become accustomed. It is enough to say that the trucks came and the superintendent stayed. Six months later he said that "these machines can't be taken away except over my dead body."

The product from two hot strip mills had been taken care

This equipment represents one of several types of electric lift trucks that lift and carry a wide range of loads in the form of reels of all diameters.

of formerly by four gangs of three men each. As fast as the hot rods came from the rolling mills they were wheeled away by hand. Periodically, it was necessary to shut down the entire plant to clear up the storage floor because of congestion, and a large amount of product had to be scrapped because of spoilage through this method of handling.

Congestion and Spoilage Eliminated

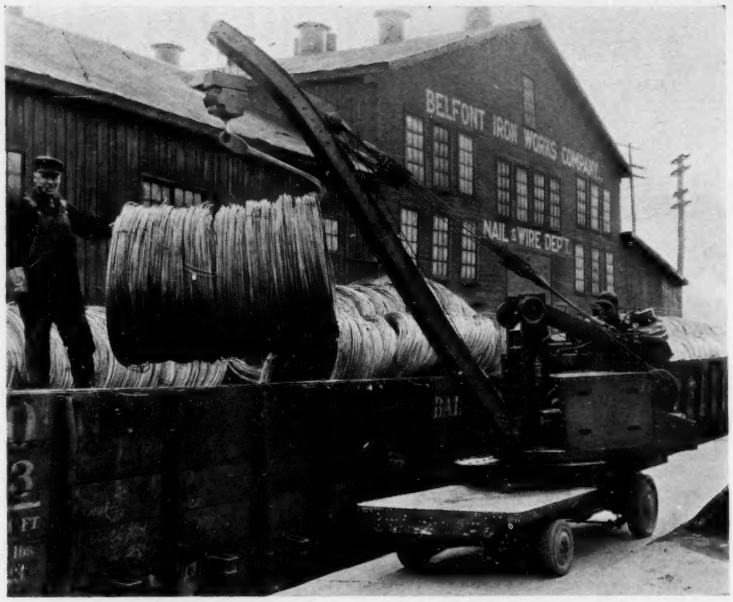
The installation of ram trucks for carrying away the rods did not solve the problem immediately because of the congestion existing at the time these machines were put into service. However, within a few weeks conditions began to improve; periodic shutdowns were eliminted and the earning power of the trucks became so high that they were paying for themselves once every month out of savings. Although the trucks used have now been in 24-hour service for two and one-half years, this record is being maintained at the present time. An idea of the capacity of these ram trucks may be gained by the fact that a random load, scale weighed, showed that 5,975 pounds was being carried.

On Sundays, when the rolls on the cold machines are changed, one of the ram trucks, fitted with a special key in the end of the ram, is used for handling them. In a Cleveland plant a crane truck is used for the same purpose.

Another novel use to which ram trucks are put at this plant is for carrying cold rolled strip in a special skid through the finishing department. This skid is built with ends of heavy sheet, with an opening cut below the center, so that when the ram is run through and the load is lifted, no pressure is brought to bear on the strip.

Nail Mill Cuts Handling Costs 80 per cent

The crane truck has ben found by several users to be well fitted for unloading as well as for loading cars or other vehicles with



The electrical platform truck with power-controlled crane has been developed to the point where it is capable of raising its load to a height of ten feet.

rods of wire. A large manufacturer of nails, rivets, etc., found that such a machine saved 80 per cent over the cost involved in handling wire manually. Formerly it was the custom to handle bundles of wire weighing 150 pounds, but with the aid of mechanical equipment of this kind, it was found possible to handle 300-pound bundles without difficulty. Consequently, every department in the plant has been affected.

Operations have been improved in wire drawing, nail and rivet making and in the annealing and galvanizing departments. The machines used are practically automatic in operation, so that the only task for the operator is to start the wire going through the machine and to remove the finished material. Therefore, by substituting 300-pound bundles for 150-pound bundles, the machines have to be charged only half as often, the cost of charging is cut in two and since it takes more of the operator's time to start the wire through the machine than it does to remove the finished product, this cost is more than half of the labor required in manufacturing. As machines have to be shut down under the new system approximately half as often as previously, the increase in capacity is apparent.

Loading Cars From Ground Level

At a plant producing hoop stock and cotton ties exclusively, the products is carried from machines to storage or direct to cars on skids. The point to be made in connection with this installation is that the entire product has to be shipped without benefit of a loading platform. The high lift truck, readily carrying its load to the level of a box car door, makes the business of shipping easy to accomplish. Doors have been cut through the building, at which cars are spotted so that the tie-in of the plant to the railroad is simple.

In assembling data covering the performance of truck equipment in all branches of the iron and steel industry, it has become clear that the hourly charge of operation seldom exceeds 60 cents and that 50 cents per hour is a fair charge under all except most difficult conditions.

Average figures covering a large number of plants in the Pittsburgh district show average savings of 52% per plant, $270 a year on the investment per plant, and an average of 7½ men per plant.

New Industrial Financing Methods Stimulate Machinery Sales

By J. A. Demarest

Vice President, Credit Alliance Corporation

THIS explanation of a system of financing instalment sales of industrial machinery was presented in an address by the author at a joint meeting of the Milwaukee Association of Industrial Advertisers and the Engineering Advertisers' Association. The plan discussed involves a new kind of commercial paper that manufacturers of industrial equipment are using through new channels of financing.

CREDIT has been defined as a temporary transfer of wealth which by virtue of such transfer becomes a contract for the future delivery of the equivalent in money or money's worth.

Credit rests on confidence; in reality its essence is the right to utilize something temporarily, the economic title to which belongs to another.

There are three general methods under which credit is extended:

1. By the ordinary open account, which is the promise to pay at no definite stated time,
2. By the taking of a note which is an unconditional promise to pay on a certain date,
3. By the taking of a note or series of notes further secured by a lien instrument retaining the ownership of the merchandise until the notes are paid.

The third method usually offers the greatest security, obviating lawsuits to a great extent, and enabling the seller to recover the merchandise upon the failure of the purchaser to pay. Naturally, this method can be applied only to machinery or such other equipment which is not consumed during the lifetime of the obligation. Under such a method, definite collateral has been substituted for confidence alone.

Turnover Gains Conserved

In all business, it is a matter of putting a dollar in at one end and taking it out at the other with a profit. But the shorter the time between the actual expenditure of money for raw material and the receipt of it in cash for the sale of the merchandise, the greater the yearly profit. Credit helps to shorten that time because by using it, the manufacturer often does not have to pay for his raw materials until he has a finished product almost ready for the consumer. Naturally he doesn't want to nullify the benefits of that situation by extending his purchaser credit and by waiting for his money, thereby losing the advantage he has gained; so that here it is often not a question of risk alone, but a loss in the turnover element of capital.

Bank Service Inadequate

Here is where the banker sometimes steps in and by discounting the purchaser's obligation, again places the manufacturer in the position of receiving cash; thereby again enabling him to accelerate his turnover of capital to advantage. Therefore, the time element is the most important thing in the employment of capital. The shorter its term of employment, the more it can be re-used, the less the capital needed, and the greater the ratio of return on capital invested.

This situation was admirably taken care of by the banks of this county up to the time when expensive complicated mass production machinery made its appearance, taking the place of labor, shortening the period of manufacture and reducing the cost. The expense of purchasing such machinery for cash became as much of an economic problem as would be the purchase of the land and factory for cash.

So the manufacturers of such machinery were faced with the lack of purchasing power of the average user and their markets were restricted to the few with large capital resources, who by virtue of their ability to acquire such machinery and thereby reduce selling prices, tended to force their smaller competitors out of business, thereby lessening the number of possible buyers. This led to the present method of instalment selling of machinery along lines similar to railroad purchases of rolling stock under what is known as equipment trusts. A substantial cash payment is secured and the balance is distributed in equal monthly notes over a period measuring conservatively the depreciated value of the equipment, the ownership being retained by the seller in the form of a title retaining instrument.

The banks, however, were unable to discount such obligations due to the fact that their resources originate almost entirely in the form of deposits, callable on demand, and they in turn are obliged to reinvest such resources in short term and liquid channels.

Paying Out of Savings

Just as labor is paid for what it has produced, at the end of the week, and after it has produced, so the modern machine taking so largely the place of labor is paying for itself out of the proceeds of its own production and saving.

(*Please turn to page 206*)

Wire Workers Reduce Industrial Accidents

Annual report of factory accident experience reflects improvement due to adoption of preventive methods

Rank	Average Number of Employees	Total Hours Worked	Number of Lost Time Accidents				Number of Days Lost				Rates	
			Death	Disability: Permanent	Disability: Temporary	Total All Causes	Death	Disability: Permanent	Disability: Temporary	Total All Causes	Frequency	Severity
1	99	136,115										
2	287	700,156			2	2			36	36	2.86	.05
3	2,109	4,764,950	1	8	17	26	6,000	8,115	489	14,604	5.46	3.06
4	622	2,965,944			19	19			114	114	6.41	.05
5	2,120	4,887,631	1	3	30	34	6,000	2,346	787	9,133	6.96	1.87
6	748	1,759,696		1	16	17		300	432	732	9.66	.42
7	43	95,244			1	1			19	19	10.50	.20
8	348	945,156		1	11	12		1,200	60	1,260	12.70	1.33
9	27	75,947			1	1			11	11	13.17	.14
10	268	688,922			10	10			240	240	14.52	.35
11	2,764	8,292,850		4	121	125		5,100	1,874	6,974	15.07	.84
12	131	393,740			6	6			42	42	15.24	.11
13	730	1,822,080			28	28			318	318	15.37	.17
14	458	1,172,480	1		18	19	6,000		508	6,508	16.20	5.55
15	709	1,504,842		3	22	25		1,800	495	2,295	16.61	1.53
16	135	355,987			6	6			16	16	16.85	.04
17	829	1,777,534		3	27	30		1,800	759	2,559	16.88	1.44
18	182	574,234		2	8	10		600	109	709	17.41	1.23
19	60	153,500			3	3			41	41	19.54	.27
20	1,127	2,750,000			56	56			508	508	20.36	.18
21	128	291,855			6	6			79	79	20.56	.27
22	264	627,478			13	13			82	82	20.72	.13
23	223	232,978			5	5			55	55	21.46	.24
24	750	1,713,504	1		37	37	6,000		800	6,800	21.59	3.97
25	178	390,390			9	9			129	129	23.05	.33
26	169	435,000			11	11			99	99	25.29	.23
27	150	314,216			9	9			206	206	28.64	.66
28	4,428	1,027,491			30	30			1,001	1,001	29.20	.97
29	1,339	3,245,404		2	104	104		1,500	1,380	2,880	32.05	.89
30	148	155,318			7	7			11	11	45.07	.07
31	200	493,000			25	25			319	319	50.71	.65
32	236	604,419			39	39			433	433	64.52	.72
Totals	and Averages											
	22,009	45,348,061	4	27	694	725	24,000	22,761	11,452	58,213	15.99	1.28
	15,593	37,880,332	5	32	1,387	1,424	30,000	24,819	16,258	71.077	37.59	1.88
	37,602	83,228,393	9	59	2,081	2,149	54,000	47,580	27,710	129,290	25.82	1.55

A tabulation of industrial accidents in thirty-two wire manufacturing plants for 1927.

STATISTICS alone will not prevent accidents, as is pointed out in the annual report of the accident experience of its members by the National Safety Council, but the study and analysis of statistics are essential to the formulation and administration of definite plans for accident prevention.

The recently compiled report for the calendar year 1927 includes sectional tabulations of reports from 2,089 manufacturing establishments, including 32 wire manufacturers with an average of 688 employees each. The smallest plant reporting had 27 employees, the largest 4,428. For the purpose of the Council a personal injury is one defined as arising out of employment and resulting in death, permanent disability, or loss of time from work other than the remainder of the day or shift on which the injury was incurred.

As will be seen from the attached table, accidents of this nature in the 32 wire manufactories resulted in a year's total of 4 deaths, 27 permanent disabilities, 694 temporary disabilities, and a total of 58,213 working days lost. Only one establishment, employing 99 workers, completed the year without a lost time injury.

The accident frequency rate (15.99) expresses the number of lost time personal injuries per one million hours exposure. Here wire manufacturing makes a very good showing, for the average accident frequency rate of all industries, representing 2,089 establishments, was 25.95. Equally satisfactory is the accident severity rate for wire manufacturing (1.28), as against an average of 1.88 for all industries. The severity rate expresses the loss in working time, expressed in days, per one thousand hours exposure.

Readers of the report are asked to bear in mind, however, that officials of an individual establishment will get little value from these figures unless they appreciate the importance of doing more statistical work than merely computing their accident frequency and severity rates. The maximum of success in accident prevention work necessitates a study of such tabulations as a classification of accidents by causes, a second classification showing who is responsible for such accident, another by departments, another showing locations, and perhaps others indicating kind of machine or process, etc—all leading to the formulation and administration of more definite plans for accident prevention.

NEWS OF THE INDUSTRY

Inquiry on Tungsten Ordered

A DOMESTIC and foreign cost-of-production investigation of tungsten has been ordered by the United States Tariff Commission, according to an oral announcement from the Commission on May 14. Tungsten is imported principally from China, and enters into the manufacture of a number of products, the Commission revealed. The steel industry is a large user of tungsten, which is imported in the form of concentrates, powder and in the natural ore. The Commission in its cost studies will consider all forms of the ore from both a domestic and foreign competitive standpoint.

Foreign Trade

FOREIGN trade opportunities reported by the U. S. Bureau of Foreign and Domestic Commerce during the month of May include inquiries from the following foreign sources: For the purchase of bolts, nuts, and chain links (31328) from Rosario, Argentina; for the purchase of fine wire for dental use (31289) from Munich, Germany; for the sole agency for poultry wire netting (31294) from San Juan, Porto Rico; for the sole agency for wire and wire nails (31205) from Amsterdam, Netherlands; for the purchase of spring-making machines, automatic (31298) from Berne, Switzerland; for the agency for barbed wire (31809) from Marcaibo, Venezuela.

THE largest German manufacturers of machinery and electrical equipment are participating in a permanent exhibition of machinery and electrical equipment recently opened in Berlin. A former department store has been remodeled for the purpose of housing the exhibits, which will be kept up to date by the addition of the latest German engineering developments of interest to manufacturers and students. The exhibition building is known as "Haus der Technik."

PARTIALLY successful experiments in the harnessing of lightning have been conducted near Geneva, Switzerland, by three scientists from the University of Berlin. A cable was swung between two mountain peaks 1,900 feet apart and at a height of 250 feet from the earth. From the middle of the cable they suspended a wire attached to oscillators with a capacity of 2,500,000 volts, with the net so arranged that the current would be grounded. It was ascertained that the steel net accumulated electrical energy from the atmosphere during a thunderstorm in which one flash of lightning fifteen feet long revealed a tension of more than 1,000,000 volts. Experiments will be continued with special oscillators which will record up to 7,000,000 volts.

AN act amending the Canadian gold and silver marking act, passed by the House of Commons on April 10, 1928, changes the name of the act to "The precious metals act, 1928," and makes it applicable to articles wholly or partly composed of platinum. The word "platinum," or any abbreviation or colorable imitation thereof, shall not be applied to any articles or merchandise, unless at least 95 per cent of the metallic content is platinum, either alone or in conjunction with iridium.

Tariff

CLASSIFICATIONS of screens in chief value of wood, for household use, under paragraph 409 of the Tariff Act of 1922, has been determined by the Bureau of Customs in a ruling just made public which makes the classification uniform throughout the customs service. When such screens are painted or otherwise decorated they are dutiable at the rate of 45 per cent ad valorem under paragraph 409.

Personal

THE Acme Wire Company of New Haven has announced the retirement of its president, Victor M. Tyler, and the appointment of Thomas G. Nee of New York to succeed him. James W. Hook, president of the Geometric Tool Company, has been chosen chairman of the executive committee.

P. A. Beaman, who has been Superintendent of the Prentiss Wire Mills, Holyoke, Mass., for the past ten years, is now with the Morgan Construction Co., Worcester, in charge of the wire machinery department. Mr. Beaman is a graduate of Worcester Polytechnical Institute, Class of 1907.

The celebration of its thirty sixth anniversary was observed with appropriate social gatherings of officers, employees and representatives by the American Chain Link Fence Company at its factories in Boston, Melford and Providence on May 2d. The present owners and managers of the business are the five sons of the late Guy Mafera, who began the manufacture of steel wire products under the American name in 1892. The company specializes in making and erecting hot-galvanized chain link fences for property protection.

Building and Expansion

THE E. H. Edwards Wire Company, San Francisco, Cal, has been granted a building permit for $45,000 for the first unit of the new buildings at Butler Road. It is understood that two buildings of even larger proportions will be constructed when the first unit is completed.

The new wire mill of the Columbia Steel Corporation, Pittsburgh, installed at a cost of $112,000, was put in operation in May. This unit produces wire poultry netting and wire mesh for stucco building construction.

Two plants of the American Cable Company will shortly be removed from Newark and Dunellen, New Jersey, to Monessen, Pa., where land is now being cleared for the erection of a building on the property of the Page Steel & Wire Company.

The recently-dissolved Rome Hollow Wire & Tube Co., Rome, New York, has been re-incorporated with a capital stock of $20,000. Among the new directors are Howard D. Wolfe, 804 North George Street, and Barton Haselton, 100 West Garden Street, both of Rome.

Chain Products Co., Cleveland, will have additional warehouse and shipping facilities at its new New York City office, 200 Varick Street. The company recently equipped a second plant in Cleveland for the manufacture of Hodell tire chains.

Wire fence and highway guard products of Page Steel & Wire Company, Bridgeport, will hereafter be distributed in Oregon and western Washington by Pure Iron Culvert & Mfg. Co., Portland, Ore.

Continental Wirebound Box Co., Houston, Texas, has purchased the business of the Republic Box Co. of the same city and is considering plans for expansion.

A new electric bulb factory will be built at Tokio, Japan, for the Tokio Electric Co. by the H. K. Ferguson Co., engineers and contractors, of Cleveland, Ohio. The cost of building and equipment is estimated at $500,000.

The Baird Machine Co., Bridgeport, Conn., is about to erect a new machine shop at an expense estimated at $80,000.

COMING EVENTS

June 13-20. Railway Supply Manufacturers' Association at Atlantic City. J. Conway, Secretary, 1841 Oliver Bldg., Pittsburgh.

June 25-29. American Society for Testing Materials at Atlantic City. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia.

June 20-22. American Railroad Association, Division of Purchases and Stores, at Atlantic City. Secretary, W. J. Farrell, 30 Vesey St., N. Y. City.

June 24-28. Association of Iron & Steel Electrical Engineers at Chicago. John Kelly, Secretary, Empire Bldg., Pittsburgh.

June 25. American Electro Platers Society at Toronto. Secretary, G. Gehling, 5001 Edmund St., Philadelphia.

Sept. 24-28. American Electric Railway Association at Cleveland. Secretary, J. W. Welsh, 292 Madison Avenue, N. Y. City.

Oct. 1-5. National Safety Council, National Congress, at New York. W. H. Cameron, Managing Director, 108 East Ohio St., Chicago.

Oct. 17-19. Society of Industrial Engineers at Rochester, N. Y. Secretary, 608 South Dearborn St., Chicago.

Oct. 2-5. National Association Ornamental Iron and Bronze Manufacturers at Boston. Secretary, C. F. Waltz, 622 Broadway, Cincinnati, Ohio.

Oct. 8-12. American Society for Steel Treating at Commercial Museum, Philadelphia, Secretary, W. H. Eisenman, 7016 Euclid Avenue, Cleveland, Ohio.

Oct. 16-18. American Railway Bridge and Building Association at Boston. Secretary, C. A. Lichty, 310 N. Waller Avenue, Chicago.

Collyer Insulated Wire Co., Pawtucket, R. I., will build and equip a new factory unit at an expense estimated at $100,000.

C. H. Smith Corporation, wire cloth manufacturers, West Springfield, Mass., has started the erection of a one-story factory addition.

The new National Wire Cloth & Iron Co., St. Paul, Minn., will specialize in the manufacture of wire window guards, coal screens and similar heavy woven products.

The Consolidated Lamp Co., Danvers, Mass., will move to its newly acquired factory at Lynn, Mass., and will expand its facilities for making electric lamps and radio tubes.

Obituary

Henry L. Scott, President and founder of Henry L. Scott Company, manufacturers of testing apparatus, died April 27th in Providence, R. I., at the age of forty-nine years. He is survived by his wife and one daughter. He established the firm in 1899 and was later joined by his brother. Mr. Scott was a member of many technical societies, including the American Society of Mechanical Engineers, Textile Institute of Manchester, England, and American Society for Testing Materials. He was of a retiring disposition and refused many offices and other honors from the societies with which he was connected. He had a great deal of interest in the Textile Committee of the American Society for Testing Materials, and for several years was very active in connection with it. For some time he served as one of the Executive Committee of the Society.

Mr. Scott was a man of a great deal of ability in many lines and combined the rare qualities of a financier, inventor and manufacturer. His poor health had not permitted him to be as active as he desired in the management of the business and for the past two years he had been in semi-retirement, the business having been managed by his brother and the association, who will continue it.

John Hinds, President of the Philadelphia Insulated Wire Company, died suddenly at Philadelphia on May 5th, at the age of sixty. Born in Belfast, Ireland, Mr. Hinds served an apprenticeship in the textile industry there before coming to the United States at the age of eighteen. After a long and successful career in the woolen field he retired, but in 1921 became interested in the insulated wire business and purchased the concern of which he was president at the time of his death. He is survived by a wife and two sons, one of whom, James L., is vice president of the wire company.

Sleeper & Hartley
TRADE MARK
REG. U.S. PAT. OFF. & PRINCIPAL FOREIGN COUNTRIES

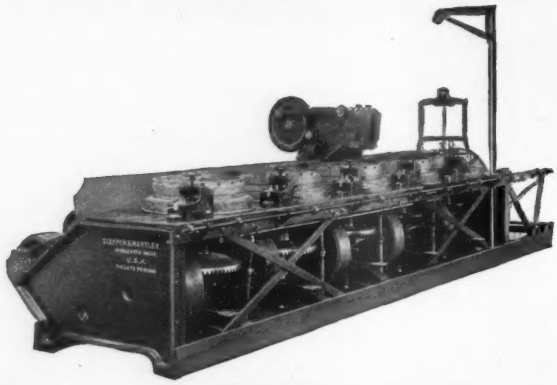
Practical Continuous Wire

These Machines Go Into Production at once—

Rod Frame

(No. 5—14 or 15 wire)
Patented June 3, 1924—May 12, 1925—others pending

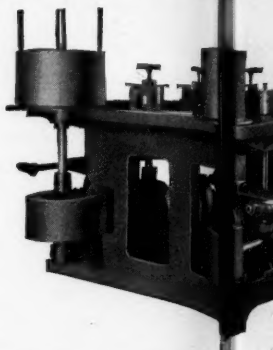
All Ball or Roller Bearings
No Differential Gearing.
Automatic Compensation for Speeds of Heads.



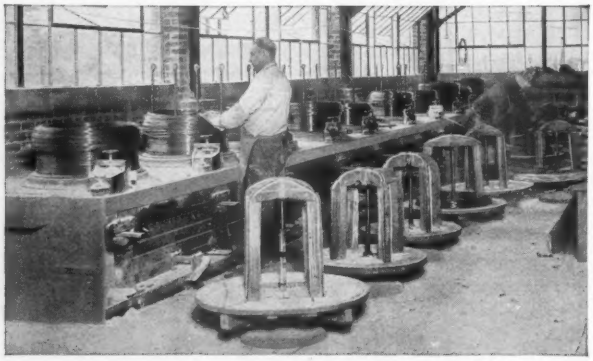
Double 5-Draft

No. 14 to No. 23.
3 to 4 Blocks
No. 14 to 19—4
No. 14 to 20—5

More than 250 heads of



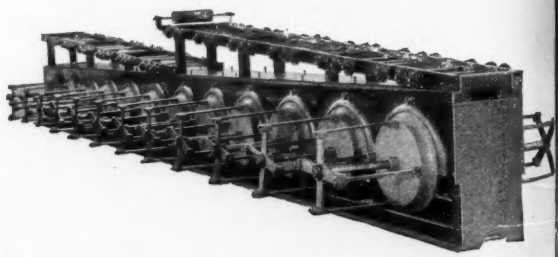
IMPROVED WIRE MILL EQUIPME



Standard Rod Frame—10 Block

Long, Stiff Spindles, in anti-friction bearings, and equipped with friction Clutches. Powerful and reliable. Practically noiseless in operation.

(New Plant of Thompson Wire Co., Worcester, Mass.)



Patenting Furnace Take-Up

(New Plant of Thompson Wire Co., Worcester, Mass.)

AGENTS: CHICAGO TERRITORY,
Neff, Kohlbusch & Bissell, Inc.

SLEEPER & HA

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KINGDOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London, E. C. 4. FRANCE—Mr. Edgar Bloxham, 12 Rue du Delta, Paris. BELGIUM—Isbecque, Todd & Cie., 25-27 Boul. Emile Bockstael, Brussels.

WORCESTER MA

Wire Drawing Machinery

Sleeper & Hartley TRADE MARK

...e—Reducing Overhead-Increasing Production!!

...ft, Intermediate

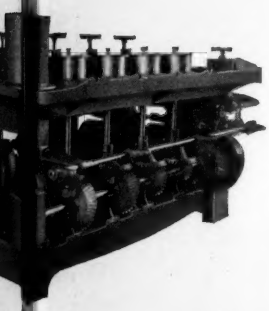
...23. ... or low carbon wire.

...ks to Average Operator.

...-4 ... 1400 lbs. per block.

...-5 ... 1100 lbs. per block.

...of ... proved model in operation

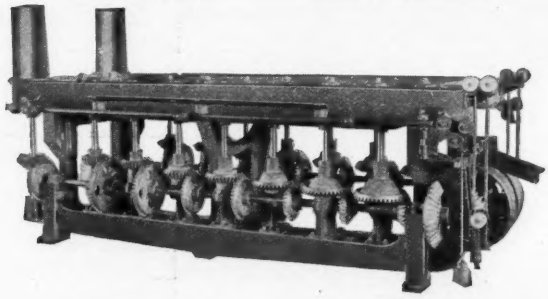


Double 8-Draft Fine Wire: Wet

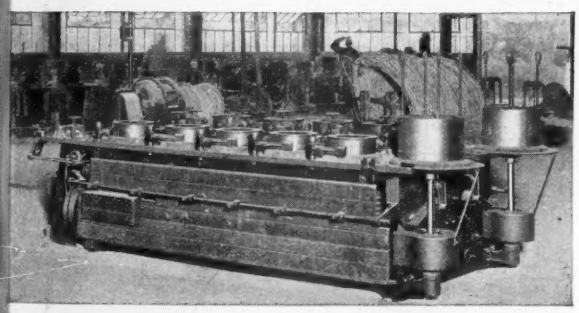
No. 22 to 36. High or low carbon wire.

6 Blocks to Average Operator, 22-33, 8-hole, 660 lbs. per day of ten hours.

Many thousands of these heads in operation



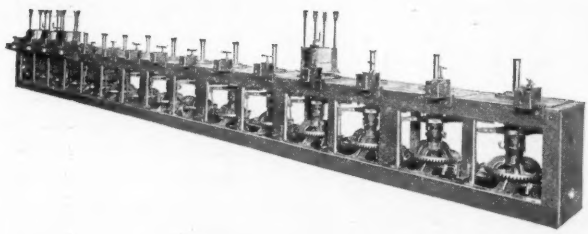
...MENT RECENTLY INSTALLED



Double Six—Draft Dry Continuous For High Carbon Wire

Direct driven with silent chain. Cut gears throughout. Anti-friction bearings. Variable speed for finishing block.

(New Plant of Thompson Wire Co., Worcester, Mass.)



Heavy 16" Frame For .65 Carbon Wire No. 10½ to .037"

15 Blocks: Motor driven. Silent chain. Anti friction bearings and cut gears throughout.

(New Plant of Johnson Steel & Wire Co., Worcester, Mass.)

...ARTLEY, Inc.

Agents: Philadelphia Territory
Swind Machinery Co.

ITALY—Henry Coe & Clerici, Milan. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Tokyo. SWEDEN AND FINLAND—Akt., Rylander & Asplunds, Stockholm.

...ERMASS., U. S. A.

Editorial By-Products

Don't Use Wire on Parcels

DISCONTINUANCE by the public of use of wire for attaching address tags on post parcels is asked by the Second Assistant Postmaster General, W. Irving Glover, in a statement just made public. The full text of the statement follows:

Many complaints are being received of injury to postal employes by wire shippers have used in attaching address tags to parcels. The department does not approve the use of wire for such purpose and postmasters are instructed to advise any patrons who prepare their mail in this manner to discontinue the practice.

Postmasters will be held accountable for parcels dispatched from their respective offices bearing address tags attached with wire.

What is an Engineer?

"IT is rather unfortunate," says a writer in the Institute of Engineers' Bulletin (Australia), that the meaning of the term 'Engineer' is popularly misunderstood. There seems to be a very prevalent idea that an engineer is a person who, in some way, has to do with engines. The precise reverse is the case. There were engineers long before there were engines. The word 'engineer' is closely allied to the word 'ingenious'. It has the same root as 'genius'. Engineering is a mode of approach. It is a way of looking at things. The engineer is one who searches about and finds the successful solution of a problem. There is room for the engineering spirit and method in every walk of life."

New Chain Annealing Tests

A DEFINITE start has been made by the Committee, of the National Safety Council, on Investigation of Effect of Annealing of Chains. A plan of procedure as announced in a recent report of the committee calls for the testing of ½-in. chain in accordance with the following outline: (1) Analysis of chain stock as received; (2) Tension proof load test and tension test to destruction of chain as received; (3) Impact test of chain stock as received; (4) Chain as received to be subjected to a repeated stress test; (5) Tension proof load test and tension test to destruction of chain after being subjected to a repeated stress; (6) Impact test of chain stock after being subjected to a repeated stress test; (7) Anneal chain at various temperatures; (8) Cooling chain in air and in furnace after being heated for annealing; (9) Tension proof load test and tension test to destruction of chain after each annealing and cooling operation has been completed; (10) Impact test of chain stock after each annealing and cooling operation has been completed; (11) Study of the effect of low temperature heating, following the same procedure as given above; (12) Metallographic studies of chain under the various conditions outlined above.

This plan of procedure was submitted to the members of the committee for consideration and may be modified somewhat in the light of comments received. The tests will be carried out at the Carnegie Institute of Technology.

World's Largest Stainless Chain

SPECIAL Sheffield steel has already been employed in the work that is being carried on for the strengthening of St. Paul's Cathedral in London, and a further interesting application of this material has been decided upon. It consists of a stainless iron chain, which is to be embedded in concrete inside the dome in order to strengthen it and preserve its shape. This chain, which is being made at Brown Bayley's Steelworks, Sheffield, will be 450 ft. long, each link having a length of 15 ft. 4 in. and width of 3⅜ in. The links are laid in four parallel lines. The chain will weigh 33.5 tons. It will be the largest chain ever made of stainless iron.

Unwinding a Spring

AN old machinist saw one of of the boys in the shop trying to straighten a coil spring with a screwdriver and a hammer on the bed of his lathe, according to Popular Mechanics, so that he could rewind the wire to make a spring of smaller diameter than that of the original one. Telling the young fellow to "fetch the spring" over to his workbench, he took it and clamped one end in the vise, inserted an iron rod in the spring and then walked backward, unwinding the spring as he went, holding the rod at both ends. Although the wire was not made perfectly straight, it was in condition to be rewound. Besides the unhandiness of the method first employed, it was hard on the lathe. The bed of a lathe is not an anvil, and it should never be used for that purpose.

Effective Material Handling Reduces Production Costs

Chicago wire manufacturer analyzes fundamental principles of materials handling for A. S. M. E.

By H. V. Coes

Vice President, Belden Manufacturing Company

THE public is slowly beginning to appreciate the fact that the cost of living is intimately related to the cost of production and of distribution—that one of the big factors in the cost of production and of distribution is the enormous toll due to handling, picking up and putting down, rehandling the materials of agriculture and industry. Think of it, a manufacturer of agricultural implements in a modern plant estimated that he had to handle one hundred and eight tons of material for every ton of finished product, f. o. b. his plant!

A survey made for a leading trade paper a year or two ago indicated that the materials handling labor cost to American industry was 22% of the total annual payroll of the American manufacturing industries in 1923.

Mr. Eugene B. Clark estimates that manufacturers in this country pay for moving materials within their plants 80% of what they pay for freight, express and parcel post annually.

It took decades and armies of men, thousands of which perished on the job, to build the pyramids or the ancient South American structures; yet we build structures of similar dimension, of infinitely greater complexity today with hundreds instead of thousands; in a year or two, instead of decades. Why! How!—by perfection of labor saving devices and organization.

Suppose we set down the known facts, such as will guide us properly to a correct solution of the materials handling problem, and the right use of materials handling devices.

As a rough guide to the conditions that demand substitution of mechanical equipment for manual labor, the author quotes the following rules. Our selection is from an address presented by Mr. Coes before the American Society for Mechanical Engineers.

1. Where three or four men are working together on one job for a couple of hours at a time.

2. Whenever a man has to lift anything from his feet to a point above his head.

3. Whenever a man has to lift more than fifty pounds from his feet to his shoulders.

4. Whenever a man has to lift more than one hundred pounds from his feet to his waist.

5. Whenever a man has to lift more than one hundred and fifty pounds from his feet to his knees.

6. Whenever a man has to stand in one place steadily moving material for over thirty minutes.

7. Whenever a man has to move material sidewise more than six feet, that is, two steps.

8. Whenever a man or a group of men has to move more than 10 tons of material per hour.

In a new industrial undertaking materials handling is an important factor in determining—

(a) The plant location.

(b) The plant layout, present and future.

(c) The departmental layouts and sequences.

(d) The production equipment, layouts and sequences.

(e) The plant output.

(f) The operating costs per unit of product.

Obviously, for a minimum investment and lowest cost of operation, consistent with the present state of the art, the new plant should be so located as to take full advantage of all the natural advantages available. The materials handling methods and devices should be sufficiently worked out at the time the plant is designed so as to make them an integral part of the design.

Every element of materials handling equipment should be selected not only to perform the work at present, but in most instances—except in specifically isolated cases, to fit into the program conceived for the ultimate plant, or the rehabilitation of the existing plant.

Eliminate all unnecessary handling operations; perform all necessary handling operations by gravity wherever economically possible. This statement seems almost axiomatic. Yet, it is no uncommon thing to go into a plant and see laborers performing operations that are totally unnecessary, many of which could be eliminated at a very moderate expense, some of which could be eliminated by the application of brains and planning alone.

Choose the methods and necessary handling operations that will result in the lowest cost. You will find very often that your first solution of the problem does not result in the lowest cost when compared with your subsequent solution. It is, therefore, decidedly advisable to compare the cost per unit handled from several practical methods of solving the problem, and then select the methods and equipment which will result in the lowest cost.

In a new plant the materials handling devices and equipment should, for lowest investment

(*Please turn to page 204*)

DIGEST OF RECENT TRADE LITERATURE

The Elimination of Industrial Waste. N. A. C. A. Bulletin, March 15, 1928. P. 803.

Due to the mismanagement of our industrial enterprises it is estimated that we have an annual waste of ten billion dollars. Fifty per cent of the responsibility is laid at the door of management, 25 per cent to labor, and 25 per cent to public relations, cancellations of orders, and miscellaneous causes. Despite the acceptance in recent years of simplification and standardization as sound business practices, over-diversification is still being carried to absurd lengths by both distributors and manufacturers.

Endurance of Metals Under Repeated Stress (Manual of). Cloth bound. 5⅛x7½. Published by Engineering Foundation, 29 West 39th Street, New York City.

A pocket-size compilation of statements, tables and diagrams edited by H. F. Moore, D. Ss., Professor of Engineering Materials, University of Illinois. Contains, within its 60 pages, condensed information culled from reports covering years of investigations by various organizations and individual research workers. An introductory historical review brings the result of these investigations down to date. The contents include chapters on machines and specimens for testing fatigue strength of metals, determination of endurance limit from data of fatigue tests, values of endurance limit for metals, characteristic examples of fatigue failure in service, and a reference bibliography.

An Experiment in Industrial Cooperation. Factory and Industrial Management, April, 1928. P. 747.

So many manufacturers in the wire and associated industries are located in industrial centers that their interest may be assumed in the results of an experiment that has been going on in Kinksport, Tenn., for more than twelve years. The industries involved have no direct financial connection or interlocking of ownerships. Most of the thirteen cooperating plants fit into the community because they were placed there as part of a planned whole. One example of interrelationship given is that of a pulp mill which supplies a book plant by way of a paper mill, thereby saving two or more handlings in the conventional channels between buyer and seller. Details about other industries are to follow.

Methods, Formulas, and Tables for the Calculation of Antenna Capacity. Scientific Papers, U. S. Bureau of Standards, No. 568. 60 pages.

Formulas are given for the common types of single and multiple wire antennas in a form convenient for numerical computation, together with tables of constants which will be found useful in such calculations. In addition, tables of the capacities of both horizontal and vertical single wire antennas and horizontal two-wire antennas have been included, which should render all calculation unnecessary in many important practical cases. This paper, by Frederick W. Grover, rectifies by appropriate inductance formulas discrepancies between the values obtained by the Howe method and published values for the same antennas by the inductance method.

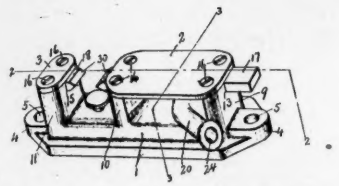
Markets For Industrial Electrical Equipment in Western Europe. Trade Information Bulletin No. 547, U. S. Bureau of Foreign and Domestic Commerce. 75 Pages.

Information compiled from various authentic sources by the electrical equipment division and intended to supply the American exporter of electrical equipment, motors and machinery with general technical data required for an intelligent study of the markets, including information on electrical current characteristics, cost of current, and regulations for the installation of motors. No effort has been made, however, to cover completely the field of regulations. Reports cover the Baltic and Scandinavian countries, Great Britain and Ireland, France, Belgium, Italy, Spain and Portugal. Aside from the main subject of the bulletin there is a great deal of supplementary information of decided interest and value about natural resources, trade customs, industrial equipment, and general business conditions in the territories reported on.

What Reorganization and Good Management Did for Otis Steel. Management, April, 1928. P. 33.

When E. J. Kulas was elected president of the Otis Steel Company, of Cleveland, on February 1, 1925, the company had just completed the most disastrous year in its fifty years history. During 1924 its operations had shown a loss of $1,400,000. Dividends on preferred stock had not been paid for several years. Sales had fallen off, costs had increased, plant and equipment had deteriorated, the bank balance was down to about $200, and prospects for the future were exceedingly gloomy. A month or two ago Cleveland financial interests made a month-by-month compilation of the records of the Otis Company for 1927. This shows profits—before the payment of Federal taxes—of approximately $1,600,000; cash and securities in banks of more than $2,000,000. In three years more than $10,000,000 had been expended in plant betterment and increased facilities, and it had not been necessary to borrow a dollar of outside capital for these purposes. In the many changes that brought about the rehabilitation, much dependence was placed upon the foremen and workmen, with whom each contemplated change was thoroughly discussed in advance.

A REVIEW OF RECENT PATENTS



Device for Wire Link Loops 1,668,942

Detailed technical descriptions are given only for the devices illustrated. All other descriptions of patents listed on this page have been abstracted from official records.

1,668,942. DEVICE FOR OPENING AND CLOSING WIRE LINK LOOPS AND THE LIKE. George B. Cady, Canastota, N. Y. 1. A device for opening and closing wire loops and the like comprising a base section having transverse openings in longitudinally spaced relation and lengthwise guide openings some distance above the bottoms of the transverse openings, a jaw mounted in one of the guide openings, and provided with a tapered inner end projecting into the adjacent transverse opening, an additional jaw slidable endwise in the other guide opening and provided with an inner tapered end movable toward and from the first-named jaw, and means extending into the other transverse opening for reciprocating the second-named jaw.

1,668,846. WIRE-FABRIC-HANDLING MEANS. Noah S. Harter, Waukegan, Ill. 1—In an apparatus of the character described, a plurality of chains for moving a wire fabric of "chain-link" character, each chain including hinged links, and each link having a hollow arched-tooth slightly skewed adapted for entrance between the linked wires of the fabric to forcibly separate such wires.

1,667,463. FASTENING DEVICE FOR FENCING. Benjamin K. Rose, Warren, Ohio. Assignor to Frost Steel Products, Inc., Warren, Ohio. The combination with a wire fence and a post of a fastening clip comprising a loop-like strand of wire surrounding one of the fence strands and the post and having ends so formed as to twist adjacent portions of the clip.

1.667.677. WIRE COILING MACHINE. Heinrich Martin Hubert Reufel and Hendrik de Jong, etc., the Hague. Assignors to General Electric Company, New York. A pair of mandrel wire feed members with winding head between them and means for positively driving both members at such relative speed as to move the mandrel wire at the same speed.

1,667,681. WIRE COILING MACHINE. Richard Shepherd and Walther Dalheimer, Eindhoven, Netherlands. Assignor to General Electric Company, New York. The combination of a rotary winding head and means for directing a mandrel wire through said head, and a driving member in positive driving engagement with said unwound mandrel wire as it passes into and with the wound mandrel wire as it leaves said winding head.

1,668,699. FLEXIBLE CONDUIT FOR ELECTRIC WIRES. Frank D. Saylor, Detroit, Mich. A flexible cable comprising a pair of insulating conductors, a spacer between the conductors, an open weave fabric surroundinlg them and impregnated with a composition containing Portland cement, and an outer finer weave fabric covering coated with said composition.

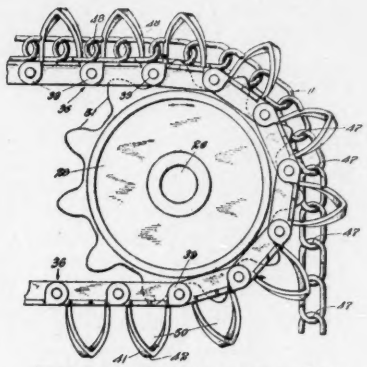
1,668,739. MANUFACTURE OF LINK MESH. Oscar Soderstrom, North Attleboro, Mass. Assignor to Whiting & Davis Company. A strip of link mesh fabric with pieces adapted for separate use for commercial purposes, the pieces being outlined in the mesh by links of a composition different from that of which links in the pieces are made.

1,668,776. STAPLE NAIL. Jason B. Manley, Oakland, Calif. Assignor to Wesley M. Wooten, San Francisco. A wire staple nail with a short prong forming a rigid driving head with two definite driving spots.

1,669,047. WIRE-TYING MACHINE. Alec J. Gerrard and Parvin Wright, Chicago. Comprises means to grip each end of the wire, to move and tension the wire, to hold it in position for twisting while being tensioned, and for twisting two parts of the wire together while under tension.

1,669,048. AUTOMATIC WIRE TENSIONING AND TYING MACHINE. Alec J. Gerrard and Parvin Wright, Chicago, Illinois. Combining a rotating gear for tensioning the wire and rotatable gear means for automatically beginning a wire twisting operation when a predetermined tension of the wire has been reached.

1,666,940. MESH MACHINE. Fred Harris Lynds, North Attleboro, Mass. Assignor to Whiting & Davis Company. A machine for making link mesh with means for controlling the action of the wire feeding devices to cause the wire to be fed in a predetermined order and in accordance with a predetermined pattern.



Wire Fabric Handling Means 1,668,846

1,666,951. MESH MACHINE. Oscar Soderstrom, North Attleboro, Mass. Assignor to Whiting & Davis Company. Comprising link and pattern forming tools and means for giving them a step by step relative movement and for operating in each period of rest of this movement.

1,667,338. APPARATUS FOR FORMING DOUBLE HEADED NAILS. Nathaniel Yates, Jr., Augusta, Kentucky. Assignor to F. A. Neider Company, Augusta, Ky. A device for inserting a headed nail in the perforation of a circular washer with means to drive washer and nail against a swage so as to force the washer material into binding relation upon the nail.

1,667,749. CABLE CUTTING DEVICE. Eugene D. Spoerri, Omaha, Nebraska. Upright rectangular frame mounted with shear blades having distinctive features.

1,667,911. WIRE BENDING MACHINE. Anton Van Veen, West Hartford, Conn. Assignor to The Fuller Brush Company, Hartford.

1,668,277. CABLE LAYING APPARATUS. Joseph Anning Kirby, Dunedin, New Zealand. A device mounted in a chassis on wheels supporting a beam and plate; means for guiding the cable through the plate carried by the beam; means for raising, lowering and inclining the beam so as to regulate the depth of entry of the metal plate into the ground.

1,668,346. SUSPENSION LINK FOR OVERHEAD CONTACT WIRES. Theodore Varney, Sewickley, Pa. Assignor to Aluminum Company of America, Pittsburgh, Pa. The combination with a main supporting wire and a secondary wire suspended therefrom, of a suspension link for electrically connecting the two, said link including a flexible loop member having a wire engaging clamp at each end, the clamp being in binding contact with the wires and loop members.

AUTOMATIC
Wire Working Machinery
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Tack Machines	Spring Machines
Screw Pointers	Chain Machines
Screw Eye Machines	Rivet Machines
Shavers & Slotters	Cut Nail Machines
Riveting Machines	Draw Benches
Wire Pointers	Bull Blocks
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Bolt & Nut Machines	Staple Making Machines
Tapping Machines	
Cotter Pin Machines	

Roll Thread Machines

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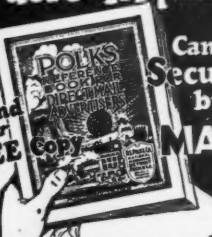

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Effective Material Handling Reduces Production Costs

(*Continued from page 201*)

costs, be an integral part of the plant in many instances. In designing a new plant and in selecting a site for one, every natural advantage that can be called to aid, either in eliminating the amount of material that has to be handled or the length of the travel, should be utilized. Frequently gravity can be made to do a large portion of the work, in which case slides, chutes, rollways, bins and the like can usually be made an integral part of the structure.

Provide for flexibility so that a failure of any of the materials handling devices or equipment will not shut down the plant. In any material handling system the equipment required for it should be so arranged and selected as to provide flexibility in operation, so that production is not tied up by the failure of any element or unit of the materials handling equipment.

The path of the material should be as direct as possible from the receiving point through processing steps without handling, and with the minimum retrogressions in the whole line of travel. Before arranging for any system of shop or plant transportation, a study should be made to see if the departments can be so arranged as to permit minimum travel in logical sequence with the minimum of retrogressive movements. In other words, do not transport materials any farther than it is absolutely necessary. Frequently a study of the departments, their relationships, the sequence of operation or processes will reveal that a rearrangement can be made.

The investment must be justified by the return. It stands to reason that the return on the investment should be such as to justify it. Many of the progressive companies have a fixed policy that provides for the scrapping of any piece of equipment or process whenever it can be shown that the proposed piece of equipment or process can earn 20 to 25%. Obviously this is good business.

The return should provide for adequate fixed charges. In order to show the proper return on the investment, provision should be made in calculating fixed charges for interest, taxes, depreciation, insurance, obsolesence, etc.

Properly selected and installed handling equipment will—

1. Permit transferring to the capital account of the portion of overhead that is composed of indirect labor.
2. Reduce the manufacturing cycle.
3. Reduce the process inventory.
4. Speed up, co-ordinate and stabilize production.
5. Facilitate the obtaining of accounting and production data.
6. Substitute automatic mechanical scheduling for the former complicated expensive schedule and production systems.
7. Govern the layout of new formance in existing plants.

We fail sometimes to realize what transportation costs. Why? Because some accountant once said that it was an overhead charge and, therefore, it is buried in that sink hole labeled "overhead". Manufacturers can tell you exactly what their raw materials cost, how much they use, what their losses were, etc., similarly with labor, and yet, few, very few, have set up the machinery to know what their shop transportation actually costs them.

When you once take the transportation problem apart, study the equipment, methods, rolling stock, right of way, dispatching, commodities handled, etc. and assets the costs properly, you will usually get a shock.

There is hardly an industrial plant where costs cannot be reduced, without necessarily reducing wages, and one of the little gold mines in which I recommend you to delve is shop transportation in its broadest

sense. You will frequently find that the outside consultant can bring to bear a wealth of experience in varied lines that will materially assist you to a right solution of the problem and the real dimensions of the justifiable expenditure.

There are many intangible benefits that directly accrue from the correct solution of shop transportation problems besides the direct labor saving. There are:

1. Reduced production space, permitting increased production in the same place.
2. Lowering the cycle of goods in process.
3. Reduction of inventories.
4. Studying of production and enhancing the control, resulting in better deliveries, increased sales and more efficient purchasing.
5. Speeding up of labor, since machines and men are not kept waiting for material.
6. Better cost and production records.

Occasionally one meets a reactionary, who immediately objects to materials handling methods because it adds complication to his plant. Complication! If you could see the complicated maneuvers some of them go through to obtain production, you would immediately say, "Yes, we'll resort to the paradox of adding complexity to complexity to attain simplicity". That may be too deep for some of the reactionaries.

New Copper Wire Merger

ON May 28, Wylie Brown, President of the new National Electric Products Corporation, announced the amalgamation of the National Metal Molding Company of Pittsburgh; the American Copper Products Corporation of Bayway, N. J., and the British American Metals Company of Plainfield. The merged companies, all of which are manufacturers of electrical transmission apparatus, will be holders of a controlling stock interest in the Habirshaw Cable and Wire Corporation.

Pressed Steel Reels that Come Back for More!

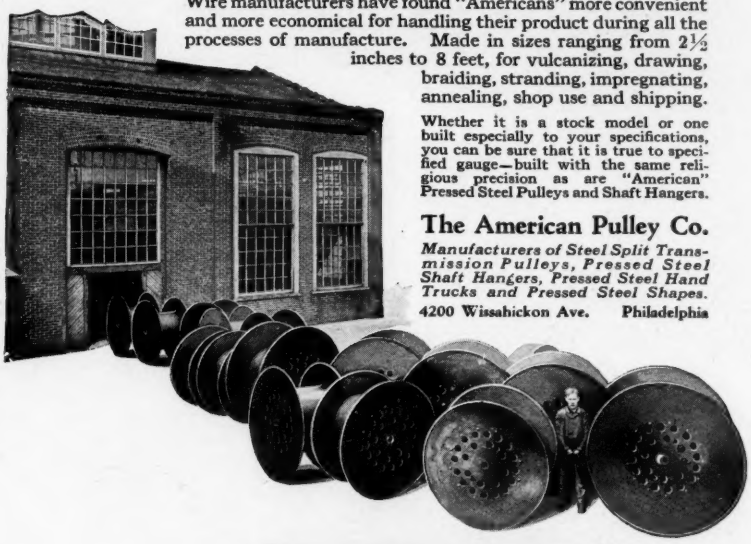
TONS of fractious, unwieldy cable require "American" Pressed Steel Reels. Practically indestructible and stronger. Wire manufacturers have found "Americans" more convenient and more economical for handling their product during all the processes of manufacture. Made in sizes ranging from 2½ inches to 8 feet, for vulcanizing, drawing, braiding, stranding, impregnating, annealing, shop use and shipping.

Whether it is a stock model or one built especially to your specifications, you can be sure that it is true to specified gauge—built with the same religious precision as are "American" Pressed Steel Pulleys and Shaft Hangers.

The American Pulley Co.

Manufacturers of Steel Split Transmission Pulleys, Pressed Steel Shaft Hangers, Pressed Steel Hand Trucks and Pressed Steel Shapes.

4200 Wissahickon Ave. Philadelphia



AMERICAN PRESSED STEEL REELS

WIRE INSULATING, STRANDING AND CABLING MACHINERY

NEW ENGLAND BUTT COMPANY

Office and Factory
304 Pearl St., Proy., R. I.

Western Office
140 So., Dearborn St., Chicago, Ill.

We build a complete line of Stranding Machines, Cabling Machines, Closing Machines, Rubber Strip Covering Machines, Measuring Machines, and Other Allied Machines for the Wire Trade.

OUR WIRE MACHINERY CATALOGUE SENT ON REQUEST

WIRE & WIRE PRODUCTS, 551 Fifth Ave., New York.

We would like to obtain information as to who is manufacturing the following articles:

We want to make .....
and would like to know the machines and manufacturers that will do it.

.....

Name .....

Firm .....

Address .....

Tinning improved—pickling time cut —and a third operation eliminated

THREE worthwhile advantages—and Oakite cleaning is reponsible for them all!

In this particular mill, the wire is given a two minute dip in a solution of an Oakite material to remove a coating of drawing soap. This leaves each coil so thoroughly clean that only 30 seconds are required to remove the scale in the subsequent pickling bath.

Moreover, such a perfect pickle is obtained that tinning is improved and the copper "strike" is no longer necessary.

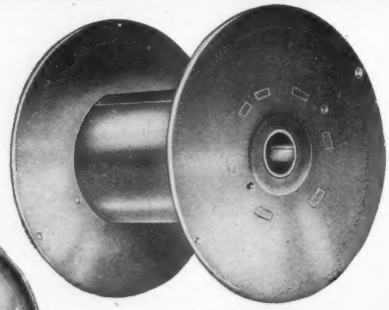
Perhaps there is a cleaning operation in your mill on which Oakite materials could be used to advantage. Our Service Man will gladly call and discuss the possibilities—without obligation, of course. A post card request brings him.

Oakite Service Men, cleaning specialists, are located in all the leading industrial centers of the United States and Canada

Manufactured only by
OAKITE PRODUCTS, INC., 52A Thames St., NEW YORK, N. Y.

OAKITE
TRADE MARK REG. U.S. PAT. OFF.
Industrial Cleaning Materials and Methods

Specializing in the Manufacturing of REELS & SPOOLS of all sizes.



For Annealing and Handling Fine Wire

Spool for Handling and Shipping Wire. (Patented)

We solicit your inquiries

Mossberg Pressed Steel Corporation
81 WEST ST., ATTLEBORO, MASS.
Russell A. Singleton Co., 2016 Cockrell Ave., DALLAS, TEX.
140 S. Dearborn St., CHICAGO, ILL.
Southern Office, 33 Norwood Place, GREENVILLE, S. C.

New Industrial Financing Methods Stimulate Machinery Sales

(*Continued from page 194*)

There is a great deal of progress yet to be attained by those who are reluctant to extend terms on such a basis. Considerable confusion has resulted by comparing this method with a similar plan under which such merchandise as automobiles, radios, etc., is sold to an individual consumer for his own pleasure or use, and where a consumer's credit rather than a producer's credit is involved.

Regardless of the merits or demerits of the instalment sales to consumers, the situation under discussion here has little to do with it. Such a plan as we are discussing brings with it the maximum utilization of capital within a given business, bringing a reduction of cost, greater profits and consequent increased wealth and purchasing power. It is money put to work and not to waste.

Expands Purchasing Capacity

In the sale of machinery, it is admitted that your product may be demonstrably of the highest quality, its use may effect definite savings in costs to the user, it may be merchandised in the most able manner, but in spite of it, your sales will necessarily be limited to the purchasing power of your prospective purchaser. In one industry, manufacturing certain machinery, the members having agreed among themselves not to give terms, they are reducing the industry they are serving to a few big combines who can afford to acquire their modern machinery for cash.

Such machinery so reduces costs that the small operator is finding it impossible to compete even locally, and his only alternative is to close his doors. On the other hand, other industries, such as laundry machinery, have, by extending terms, opened additional markets by making it in many cases as cheap for householders to send their laundry out as to do it in the home.

Our organization has created many merchandising plans in connection with the industries it finances. In doing so, we have taken into consideration the ideal situation which would insure complete distribution; that is, if the recipient could get it for nothing. It is human for the average man to dream about schemes whereby he can get something for nothing—a quick profit, a quick turn and no investment.

We may say that we have endeavored to take such a situation and make it workable, bankable and profitable. For instance, assume you have a machine which really saves money, or in other words, earns money, and you sell it on terms over a period of time which would permit the savings to pay for the cost of the machine. The result would be that if the machine did actually pay for itself, the purchaser would have the machine for nothing.

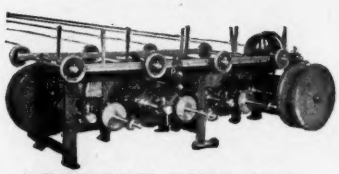
To prove our theory of banking and finance, we went to an industry where the average cost of a mechanical installation was $150,000, and the average purchaser an AAA concern.

We had our client make a survey of conditions in the industry and its various plants, ascertain the former mode of manufacturing of that given product and the cost, and the savings through the new method. We then arranged a plan on a basis where they could go to the manufacturer and say:

"Here are the facts as they appear from your findings and ours. If we are right, the savings will pay for our installation over a certain period. To prove to you that we are sincere, if you will make a small payment to cover the freight and part of the installation we will agree to take the savings by reason of this new installation until the total sum of the purchase price has been paid, so that after so many months you will have the installation paid for out of production rather than capital."

As a result the client has been able to sell over thirty of these

EST. 1855 AIMCo INC. 1918
"American" INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.
517 Huntington St.
PHILADELPHIA PENNSYLVANIA U.S.A.

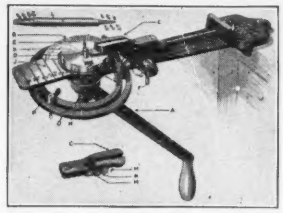


MACHINES FOR
DRAWING
RESPOOLING
SATURATING
RECLAIMING
ENAMELING
INSULATING
PANNING
VULCANIZING
TAPING
OF WIRE

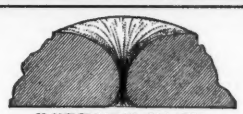
MULTIPLE PULL-OUT
With TRAVERSE for 8 Reels.
Has 8 Independently Operated
FRICTION CLUTCHES

KILMER LITTLE GIANT WIRE FORMER

Forms Eleven Sizes of Eyes from Round, Square, Flat or Half-Round Stock, also almost any shape desired Quickly and Efficiently.
Adjustable for No. 3 to No. 24 Gage Wire.
The cut on the left shows a few of the thousands of the forms made on this
FORMER
Price $50.00

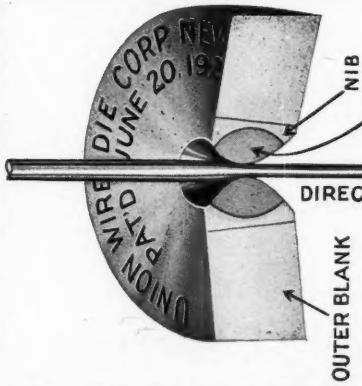


Patented April 2, 1918
M. D. Kilmer & Co. Cleveland, Ohio, U. S. A.
Box 237, Station B.



WATCH THE SHAPE
COCHAUD
Wire Die Corporation
Wire Drawing Diamond Dies
300 West 56th St., New York
Tel. Columbus 10148

"The House of Service"
BELLET & BOUVARD
Manufacturers of
DIAMOND DIES
Factories { Trevoux / Les Abrets } France
New York Office 315 Fifth Ave.



Sectional View of round stone diamond die setting designed to resist drawing strains and the effects of vibration.

The Patented Diamond Die
of proven superiority through practice, not theory.
The standard of leading wire mills.
Manufactured by:
UNION WIRE DIE CORP.
250 W. 40th St., New York City

Wire Drawing Soaps and Compounds

STEELSKIN BRAND

(Registered)

For High or Low Carbon Wire

Working Samples sent on request.

Established 21 years.

R. H. MILLER CO., INC. **HOMER, N. Y.**

ERNST JELLINGHAUS,

VOERDE i./Westf. GERMANY

Werkzeug-und Maschinenfabrik

Netting Pinions for Wire Netting Machinery

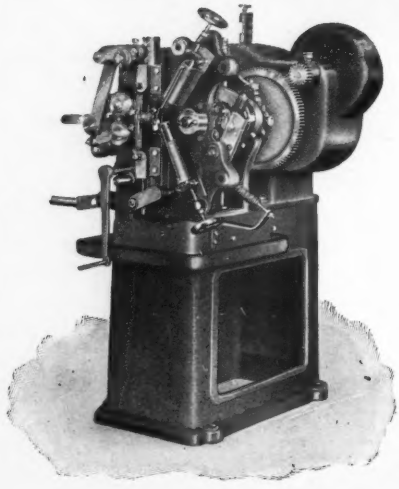
(For hexagon and triangular netting) made from a Special Steel of about 70—80 kg solidity, and

hardened Screws (bushes for same)

First class workmanship, in all sizes wanted, as per sample or drawing.

also vertical

Spring Coilers



Automatic

Non-Automatic

for

Mattress Springs
Upholstery Springs
Clothes Pin Springs
Endless Coils
Open and Closed Springs
Conical and Semi-conical Springs
Cylindrical Springs, etc., etc.

Wafios Wire Working Machinery

Canadian Branch:
437 St. James Street, Montreal

J.I.BERNITZ
25 BEAVER St NEW YORK CITY
GENERAL AGENT FOR USA AND CANADA

installations at an average price of $150,000. The manufacturer has not only made a profit on the thirty installations, but by reason of these installations has a revenue of over $75,000 a year in royalties.

The average purchaser of anything is sometimes skeptical. He feels that he may be overcharged. He is not certain of the product. A sales plan or salesman must first break down this suspicion and establish confidence. The best form and manner of doing this is by backing the promise with real cash, instead of asking the purchaser to gamble with his money on your product. If you can reverse it, and show him that you are ready to gamble with your money on his proposition, you have a different psychological status.

Merchandising means to instill an idea or desire for a particular thing. This requires creative psychological work. High pressure salesmanship without a concrete plan, properly and scientifically worked out, and without the backing of your own dollars and cents will be of no avail.

New Markets Essential

About a year ago, it seemed apparent that the tremendous competitive conditions brought about by mass production, intensive merchandising and competitive prices would tend to operate to increase volume and lessen profits. During the past year, this has been the case in many industries. It has further resulted in overstocking the purchaser in many instances. Furthermore, the tremendous industrialization of plants with the consequent elimination of labor has come to a point where in the first quarter of this year, statistics indicate an increase in production of 5 per cent with a corresponding decrease of employment of 7 per cent. Inasmuch as unemployment reduces the purchasing power of consumption, if we are to continue to produce in this manner, we are faced with the necessity of developing other markets.

The Development of the Diamond Drawing Die

(*Continued from page 191*)

which is left free to perform its own important function.

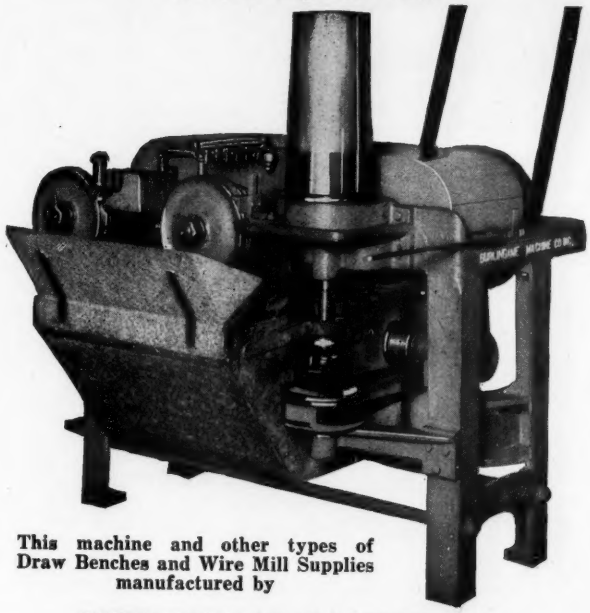
The backs of all our dies now conform to this improved design, but our experience under practical working conditions in drawing wires of various metals has resulted in bearings especially shaped for particular purposes ranging from the drawing of soft copper to that of Nichrome IV, which is much harder than tungsten, is drawn cold, and presents the severest kind of test that the diamond die is likely to meet.

Next in importance to the weight and quality of stones and improved structural design came the consideration of operating defects due to settings, for the best diamonds obtainable will break down under strain if imperfectly set, the large and expensive ones just as quickly as the small. The custom of using brazed metal settings was an invitation to trouble from unexpected blow holes. An inconspicuous drop of oil or shellac or other foreign matter might cling to the stone, from a blow hole, and leave the diamond at that point without support from the surrounding metal. Naturally the point thus weakened gets more than it share of the burden and cracks or breaks.

As a means of insurance against this kind of mishap—a familiar experience to users of the older type of die—the shaped diamond is now cleaned with clinical thoroughness and never touched by hands again until it is cast in steel. The next operation is to turn down the steel pellet and cast it in brass, making a completed die that resembles the old style brazed product only in appearance.

In effect the new type of die is virtually a draw-plate tool of one piece, an effect produced by the solid construction and interrelation of its parts.

Continuous Wire Drawing Machine
6 Draft Liquor Finish
For Drawing Fine Wire



This machine and other types of Draw Benches and Wire Mill Supplies manufactured by

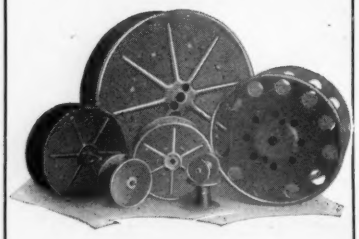
BURLINGAME MACHINE CO.
149 COMMERCIAL ST., WORCESTER, MASS.

M. A. IRMISCHER
Machinery for the Wire Industry
48 EAST 41st STREET, NEW YORK CITY

HIGH PRODUCTIVE:
Bolt Presses
Nut Presses
Rivet Presses
Chain Forming Machines
Pin and Needle Machines
Point Grinding Machines
Poultry Netting Machines
Wire Staple Machines
Wire Spooling Machines
Wire Weaving Machines

Expert Engineer Service
available at all times

Steel Spools and Reels for Wire Work



Throughout the wire industry pressed steel spools and reels are becoming recognized as real money savers.

If you contemplate modernizing your equipment, let APCO MOSSBERG engineers submit some figures to you.

Apco Mossberg Corporation

13 Lamb St., Attleboro, Mass.

Specialists in Developing Steel Reels for Annealing, Vulcanizing and Stranding; Also Bobbins for Wire Weaving.

Drawing Steel Alloy Wires

(*Continued from page 190*)

Several other types of alloys which are manufactured in the form of wire remain to be mentioned.

Manganese steel, which contains about 12/13% manganese, has been successfully drawn, and has been used for various purposes where resistance to abrasion is important. This steel is a difficult one to manipulate, as is has to be heated up to 100°C. and then plunged into water to make it ductile enough for cold work. The cleaning of this steel may be conducted, as usual, by pickling in acids.

Nickel and Nickel-chrome steels have already been referred to at the beginning of the chapter, but there are certain alloys of these metals with iron which, although not strictly speaking steels, are yet included here because they are usually manipulated in an iron and steel wire mill.

One of these alloys contains 25% nickel, and although theoretically this is not intended to be a steel, in practice it always is so, because of the presence of carbon in sufficient quantity to form austenite. This alloy is used for electrical resistances such as rheostats, etc. It has approximately a resistance equal to 50 times that of copper. As a pure nickel-iron alloy, without carbon, it is quite ductile and easily drawn into wire, but the presence of carbon tends to decrease its ductility—so much so that it is sometimes necessary to soften it by quenching from 1000°C.

Another nickel-iron alloy which finds a special use in the form of wire is the alloy known as "Invar", which contains about 36% nickel. This alloy has the peculiar property of having practically no co-efficient of expansion, and is very useful for certain purposes—such as pendulums for very accurate clocks, which do not vary in length with the rise or fall of temperature. Considerable care is necessary in drawing these alloys, because if they are the least bit overstrained surface cracks are apt to develop during the annealing operation.

Nickel-chrome Alloys

This series of alloys is now used extensively for high temperature resistance wire. They are not steels, and one of them is really a non-ferrous alloy, but they are dealt with here because they are generally drawn in a steel wire mill. The analyses of three typical alloys of this nature are given below:

Nickel	65	75	85
Chromium	12	12/15	15
Iron	23	8/10	.1 max.

These alloys are annealed in a hermetically sealed pot at a temperature of about 750°C. They are extremely difficult to clean and draw. Cleaning may be carried out in nitric acid, or in aqua regia; and thorough lubrication is of importance in drawing, otherwise the wire will not be true to size. The reason for this is that chromium is a metal that resists abrasion more than any of the ordinary metals we know of. These alloys can be drawn two or three holes between each annealing, but the reduction must be slight—not more than 20% in area at each pass.

These are practically all the alloys and alloy steels which are drawn into wire; a few other special alloys have been drawn, but only so very rarely that no special mention of them is required. There are, indeed, very few alloys produced which cannot be made sufficiently ductile, under proper annealing conditions, to enable them to be drawn into wire.

Illustrations of the structures of some of the alloys mentioned are given in Figs. 7 to 10. As might be expected the alterations in the structure due to drawing these alloys are very slight, because few of them are drawn more than a pass or a couple of passes between each annealing, and, although the effects of this slight cold working can be detected by visual examination under high magnification, they are not sufficiently

obvious to be illustrated by photomicrograph. In the case of manganese steel, and also in the 25% nickel resistance alloy, which contains a little carbon, there is one interesting feature of the effect of cold working—viz: the conversion of austenite into martensite; this is one of the few cases so far known in metals of a mechanical process producing a chemical change. Slight evidence of this change is visible in Fig. 8.

All-America Cables Celebrates Fiftieth Anniversary

THE fiftieth anniversary of the establishment of cable communication between United States and Central and South America was observed on May 6th. The "via All America route" now comprises 26,479 miles of submarine cable and land lines, comparing with 4,587 miles in 1882. Before 1882 the rate from New York to Buenos Aires was $7.50 a word. The extension of the All America system to Argentina in 1892 brought with it a reduction to $3.98 a word. In 1907 the toll was reduced to $1, and in 1917 to fifty cents. A further reduction to forty-two cents went into effect last August, with corresponding reductions in the rates to other countries of Central and South America and the West Indies. The present company, All America Cables, Inc., traces its history back to the formation of the Mexican Cable Company in 1878 by the late Captain James A. Scrymser, Civil War Veteran, who in 1866 had founded the International Ocean Telegraph Company, which was taken over twelve years later by the Western Union. The present corporate title dates from 1920, when the present head, John L. Merrill, succeeded Captain Scrymser as president.

URDIKA

ELMARID

The most improved metal composition die.

Manufactured in sizes ranging from .020" to .300"

STEEL SET

DIAMOND DIES

Highest Quality

Accurate Size Smooth Draw

URDIKA

WIRE DIE WORKS

105-107 Fulton Street New York City

WIRE DRAWING DIAMOND DIES

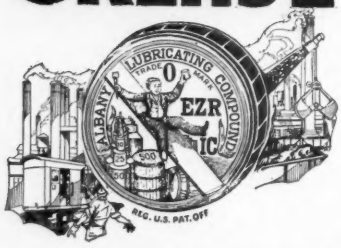
Over 30 years experience in this line. The best equipped establishment in America with modern methods and machinery.

New way for re-inforcing the diamond.

(U. S. Patent 1,624,027. April 12, 1927.)
Tel. Webster 5105, Cable Address: Krauseco

F. KRAUSE & CO., Inc.
250-252-Ogden Ave.
JERSEY CITY, N. J.

ALBANY GREASE



The only grease old enough to prove it will lubricate a machine for life.

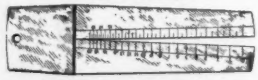
Albany Grease has stood the test for 60 years . . . . a 100% pure tallow compound—never drips. Thousands have found it unequaled thoughout a lifetime of constant use.

Always look for the Albany Grease Trade Mark—Refuse substitutes.

Your dealer can supply you.
If not, write us.

ADAM COOK'S SONS, Inc.
6 VARICK STREET NEW YORK

A. WALDECK & COMPANY
Wire Gauges



6707 Broadway, S. E.
CLEVELAND, OHIO

Broden Construction Co.
Wire Mill and Cold Rolling Equipment
10255 Harvard Ave.
CLEVELAND, OHIO

Domestic Exports of Iron and Steel Wire, Wire Rope and Nails, From the United States, By Countries

March, 1928

Countries	Plain iron or steel wire	Galvanized wire	Barbed wire	Wire rope	Insulated iron or steel wire and cable	Wire nails
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Belgium	2,067	.....	.....	.....	.....	.....
Denmark	300	.....	.....	.....	.....	.....
Finland	50	.....	.....	.....	.....	.....
France	500	.....	.....	.....	.....	.....
Italy	.....	.....	.....	2,826	.....	.....
Norway	6,000	.....	.....	.....	.....	.....
Poland & Danzig	15,211	.....	.....	.....	.....	.....
Portgual	1,038	.....	.....	.....	.....	.....
Soviet Russia in Europe	.....	.....	.....	3,585	.....	.....
Spain	1,038	.....	.....	3,020	.....	.....
Sweden	200	.....	.....	.....	.....	.....
Switzerland	738	.....	.....	27	.....	.....
United Kingdom	138,765	69,755	.....	13,505	2,307	71,462
Canada	1,328,715	3,821,296	1,366,172	124,252	7,354	6,271
B. Honduras	.....	2,029	.....	648	.....	490
Costa Rica	2,656	.....	89,200	3,657	.....	7,162
Guatemala	13	5,555	276,694	525	4,414	29,125
Honduras	1,465	300	148,352	2,645	.....	91,122
Nicaragua	2,765	.....	162,716	6,739	.....	16,280
Panama	499	33,224	242,262	38,261	50	100,379
Salvador	3,600	.....	120,615	318	159	5,500
Mexico	334,357	199,940	1,047,408	62,384	8,789	60,806
Miquelon & St. Pierre Is.	815	.....	.....	.....	.....	.....
Newfoundland & Labrador	705	.....	.....	250	.....	1,170
Bermudas	362	1,282	.....	.....	.....	.....
Jamaica	500	10,196	179,682	376	.....	1,900
Trinidad & Tobago	660	10,018	.....	22,339	506	.....
Other B. W. Indies	3,000	1,000	13,300	1,976	54	19,900
Cuba	89,197	140,430	829,511	86,035	7,619	435,481
Dom. Rep.	46,236	583	187,230	4,243	1,661	78,688
Netherland W. Indies	736	60	12,250	3,320	.....	16,568
Haiti, Rep. of	7,000	.....	2,050	2,150	.....	27,000
Virgin Is. of U. S.	.....	200	15,600	.....	.....	1,000
Argentina	715,640	2,459,077	2,704,939	145,201	19,848	2,000
Bolivia	.....	.....	.....	6,032	.....	.....
Brazil	48,559	45,674	3,752,537	27,241	66,462	2,346
Chile	1,887	3,401	159,671	31,613	112	48,470
Colombia	98,358	75,026	1,089,048	17,889	1,410	266,379
Ecuador	200	.....	40,750	.....	.....	31
Surinam	.....	.....	1,000	560	.....	.....
Paraguay	.....	.....	.....	.....	.....	6,614
Peru	15,129	48,899	85,225	38,338	275	25,104
Uruguay	46,375	133,084	45,106	1,644	.....	.....
Venezuela	.....	2,236	238,424	116,362	4,545	47,031
B. India	.....	.....	.....	4,850	.....	.....
B. Malaya	.....	.....	187,375	5,532	.....	78,500
China	5,600	222,342	9,921	250	.....	345,000
Java & Madura	.....	.....	157,817	97	.....	.....
Other Netherland E. Indies	.....	.....	172,589	6,970	.....	660
Hong Kong	.....	.....	.....	.....	.....	3,672
Japan	4,723	238,332	.....	486	5,325	15,215
Kwantung	.....	.....	.....	.....	3,814	.....
Philippine Is.	500	107,612	917,650	202,306	.....	778,577
Siam	.....	14,360	102	.....	.....	.....
Australia	499,580	79,420	56,000	.....	.....	6,625
B. Oceania	.....	.....	.....	.....	.....	1,120
F. Oceania	.....	.....	3,032	450	.....	1,600
New Zealand	2,415	73,120	.....	1,089	325	.....
B. E. Africa	.....	.....	.....	585	.....	.....
Union of S. Africa	4,000	96,519	440,535	.....	.....	252
Egypt	.....	33,698	.....	.....	.....	.....
Liberia	.....	.....	.....	.....	.....	13,100
Other P. Africa	.....	700	.....	.....	.....	.....
B. Guiana	464	.....	.....	70	.....	.....
Total Quantity	**3,432,618**	**7,929,368**	**14,754,763**	**990,646**	**135,029**	**2,632,600**
Total Value	**164,388**	**220,051**	**498,005**	**130,622**	**22,847**	**77,264**

Shipments from the United States to Non-Contiguous Territories.

Alaska	.....	.....	.....	.....	.....	191,143
Porto Rico	2,275	18,635	328,470	24,757	.....	351,590
Hawaii	39,463	174,666	12,229	12,736	3,702	400,356

OUTSTANDING gains in exports of iron and steel wire and wire products for the first quarter of 1928 were made in Barbed Wire and Woven Wire Fencing (17031 gross tons) and Plain Wire (12,070 gross tons). The first classification shows an increase of 85% over the same period in 1927. About half the total shipments went to Argentine, Brazil and Mexico. Exports

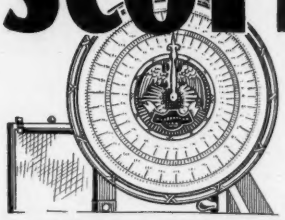
Domestic Exports of Iron and Steel Wire Manufactures, Household Nails and Horseshoes From the United States, By Countries

March, 1928

Countries	Woven wire fencing	Woven wire Screen Cloth		Wire n. e. s. & manufactures of	Horseshoe nails	Horseshoes
	Pounds	Pounds	Dollars	Pounds	Pounds	Pounds
Austria	.....	.....	.....	635	.....	.....
Azores and Maderia Islands	.....	.....	.....	75	.....	.....
Belgium	.....	.....	.....	680	.....	.....
Czechoslovakia	.....	.....	.....	929	.....	.....
Denmark	.....	.....	.....	16,149	.....	.....
Finland	.....	.....	.....	944	.....	.....
France	.....	.....	.....	3,335	.....	.....
Germany	.....	325	111	200	.....	.....
Greece	.....	.....	.....	74	.....	.....
Irish Free State	34,628	.....	.....	996	.....	.....
Italy	.....	.....	.....	9,716	.....	.....
Netherlands	14,199	.....	.....	4,770	5,390	.....
Norway	.....	.....	.....	5,990	.....	.....
Soviet Russia in Europe	.....	.....	.....	523	.....	.....
Spain	613	.....	.....	844	.....	.....
Sweden	.....	.....	.....	175	.....	.....
Switzerland	.....	.....	.....	82	.....	.....
United Kingdom	67,844	774	209	293,924	.....	.....
Canada	191,457	99,235	25,443	632,380	115	40,577
British Honduras	112	129	33	492	.....	.....
Costa Rica	2,755	376	30	888	2,000	8,600
Guatemala	2,156	.....	.....	5,060	625	.....
Honduras	5,922	353	58	491	.....	200
Nicaragua	818	18,115	838	752	.....	100
Panama	18,509	2,270	299	5,504	.....	1,284
Salvador	8,160	7,527	1,025	846	2,425	.....
Mexico	138,246	60,529	7,777	286,806	38,440	8,960
Newfoundland and Labrador	.....	609	66	1,222	.....	.....
Bermudas	388	996	160	1,353	50	822
Barbados	861	.....	.....	.....	.....	.....
Jamaica	6,192	634	124	2,810	82	.....
Trinidad and Tobago	4,433	.....	.....	2,715	.....	2,000
Other British West Indies	5,525	1,649	360	2,578	.....	200
Cuba	124,997	14,727	2,294	161,515	7,474	7,100
Dominican Republic	1,937	4,180	863	58,923	300	3,414
Netherland West Indies	17,378	1,688	232	1,504	.....	.....
French West Indies	.....	1,273	237	.....	.....	.....
Haiti, Republic of	1,085	2,776	660	1,392	.....	.....
Argentina	196,545	10,170	1,935	37,822	25,893	.....
Bolivia	.....	5,443	1,589	3,299	.....	.....
Brazil	6,000	99	34	113,120	2,300	.....
Chile	372	3,325	627	9,078	48,616	2,100
Colombia	2,926	3,856	591	3,371	15,891	.....
Ecuador	.....	.....	.....	15,678	.....	.....
British Guiana	.....	125	51	135	.....	.....
Surinam	.....	54	13	.....	.....	.....
Peru	.....	1,821	376	26,158	6,000	.....
Uruguay	.....	.....	.....	1,205	.....	.....
Venezuela	3,513	6,605	969	5,887	.....	.....
British India	53,874	2,535	664	159,251	.....	.....
China	12,811	48,225	8,609	127,577	20,000	.....
Java and Madura	.....	.....	.....	3,200	.....	.....
Japan	1,737	68,318	12,825	105,021	17,700	.....
Persia	.....	.....	.....	3,486	.....	.....
Philippine Islands	148,227	10,902	1,882	1,758	150	.....
Siam	3,588	2,173	469	.....	.....	.....
Australia	.....	2,658	626	56,332	7,000	10,080
British Oceania	.....	809	134	180	.....	.....
French Oceania	5,200	.....	.....	159	.....	.....
New Zealand	.....	1,499	437	16,108	6,767	.....
British East Africa	918	.....	.....	.....	.....	.....
Union of South Africa	1,562	8,315	3,650	5,784	2,100	.....
Other British South Africa	.....	261	96	.....	.....	.....
British West Africa	60	.....	.....	.....	.....	.....
Egypt	3,142	.....	.....	601	.....	.....
Alberia and Tunisia	.....	.....	.....	256	.....	.....
Other French Africa	648	.....	.....	.....	.....	.....
Liberia	860	2,166	276	.....	.....	.....
Mozambique	.....	548	185	715	.....	.....
Other Portuguese Africa	6,267	.....	.....	.....	.....	.....
Canary Islands	.....	.....	.....	145	.....	.....
Total Quantities	**1,096,465**	**398,072**	.....	.....	.....	.....
Total Values	**54,975**	.....	**76,857**	**2,208,949**	**209,318**	**85,437**
Shipments from United States to Porto Rico	21,271	5,176	647	11,566	3,425	20,906
Hawaii	61,071	29,035	9,952	20,845	8,070	11,385

of plain wire showed an increase of 68% over the corresponding period last year. Canada was by far the largest customer, taking about one-third of the total. There were no appreciable gains or losses in exports of Wire Cloth and Screening, Wire Rope, Insulated Wire and Cable, Wire Nails, or Miscellaneous Manufactures of Wire. The most active month was March.

SCOTT



HORIZONTAL & VERTICAL TESTING MACHINES FOR WIRE

Give visible reading and graphic charts showing strength, stretch, elongation and action under stress. Used to establish standards governing purchasing and manufacturing.

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Vaughn Machinery Co., Cuyahoga Falls, O.

CLEANING COMPOUNDS

Oakite Products, Inc., N. Y.

CRANES

Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIES—Chilled Iron

The Waterbury Wire Die Co., Waterbury, Conn.

DIES—Diamond

Bellet & Bouvard, N. Y.
Cochaud Wire Die Co., New York.
Driver-Harris Co., Harrison, N. J.
F. Krause & Co., Inc., Jersey City, N. J.
Union Wire Die Corp., New York, N. Y.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Works, New York.
The Waterbury Wire Die Co., Waterbury, Conn.

DIES—Repairs & Re-Cutting

Bellet & Bouvard, N. Y.
Cochaud Wire Die Corp., New York
F. Krause & Co., Inc., Jersey City, N. J.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Wks., N. Y.

DRAWING COMPOUNDS

Oakite Products, Inc., N. Y.

FURNACES—Wire Annealing

Vaughn Machinery Co., Cuyahoga Falls, O.

GAUGES—Wire

A. Waldeck & Co., Cleveland, Ohio.

LATHES—Die Reaming

Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

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Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson.

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Riehle Bros.
Henry L. Scott Co., Providence, R. I.

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Sleeper & Hartley, Inc., Worcester, Mass.
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Watson Machine Co., Paterson.

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M. A. Irmischer, New York.

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MACHINERY—Insulating

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MACHINERY—Nail

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M. A. Irmischer, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

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Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

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MACHINERY—Spooling

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Sleeper & Hartley, Inc., Worcester, Mass.
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American Pulley Co., Philadelphia, Pa.
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Mossberg Pressed Steel Corp., Attleboro, Mass.

PRESSES—Rivet & Bolt

M. A. Irmischer, New York.

SOAPS—Wire Drawing

R. H. Miller Co., Homer, N. Y.

SPOOLS—Wire & Cable

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Apco-Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

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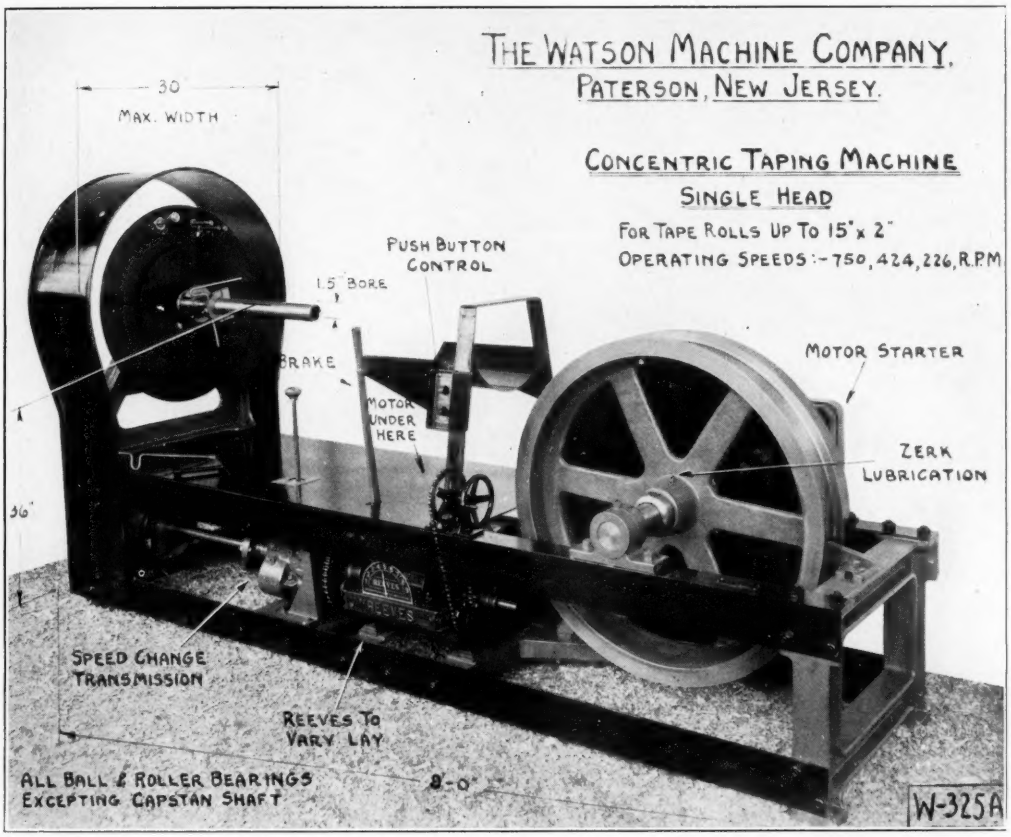

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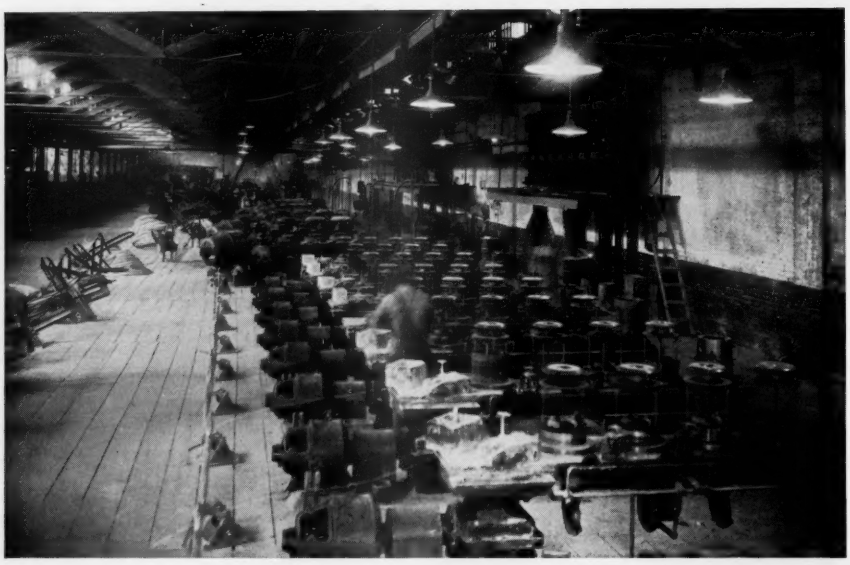
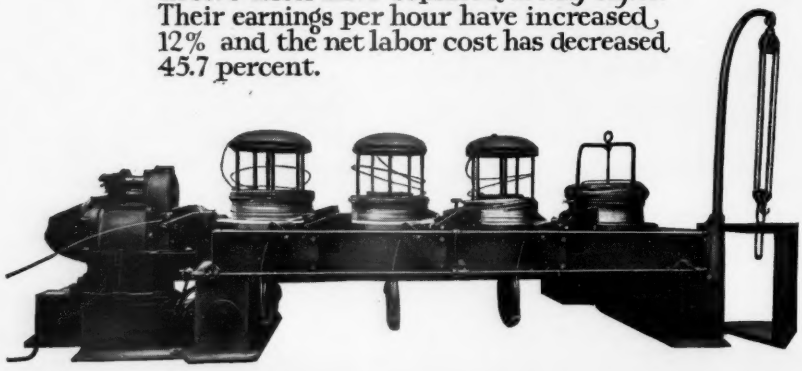


Through this installation of
Morgan Connor Wire Machines
twelve men have replaced *twenty-eight*.
Their earnings per hour have increased
12% and the net labor cost has decreased
45.7 percent.



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